POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF PRIVATE FLYING AND COMMERCIAL AVIATION

Volume XIX | OCTOBER, 1936 | Number 4

TABLE OF CONTENTS

FEATURE ARTICLES

An Airy Chat With the Editor 12
The Unbelievable Truth About Hammond's Plane 14
Bleriot's Channel Crossing 17
Military Aviation in Japan 19
". . . Clear and Unlimited" 21
Proposed Altitude Rocket Hops 23
French Lightplane Aviation 25
Still More World War Planes 26
Details of the Latest Lamberts 27
The National Air Board Says 29
The Lear Aircraft Radio 31
Centrifugal Propulsion 35
Gossip Along the Airways 37
Stress Analysis Made Painless 39
Something New in Self-Starters 41
Hints for the Home Builder 43
The 1936 Texaco Gas Model Events 45
Building the Hawker Merlin (Model) 47

PICK OF THE BRIEFS

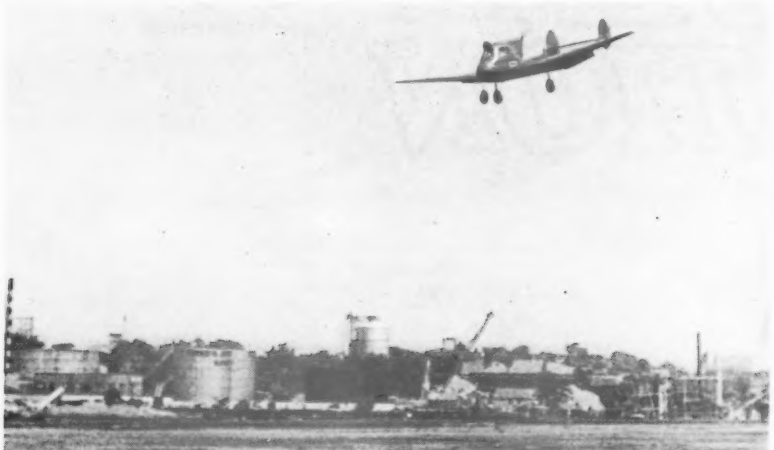
Two New Seaplane Jobs—A Cub and Stinson 16
A New Member of the Porterfield Family 18
Eddie Rickenbacker Discusses War Planes 18
Betty Snell—A Canadian Pilot 20
College Students Design Dream Ship 20
A Parachute Ambulance 20
Blimping in the Early Days 22
Latest French Flea Activities 24
Two Famous Bombing Chiefs 24
Bunting I., built by Curtiss-Wright Students 28
New Lockheed 12 Exceeds 250 M.P.H. 28
The Loire-Nieuport Pursuit Plane 30
A Few French Aviation Notes 30
An Immersion Type Oil Heater 32
Solidified Gasoline 32
Canadian Air Ventures 33
Strange as It May Seem (Cartoon) 33
Britain's Formidable Fairey Battleplane 34
The New C-6 Waco 4-5 Place Cabin 38
Miss Streamline's Anniversary 38
Analysis of Aircraft Metals 40
Hold Last Rites for Earle Ovington 42
Smallest Racing Plane in the World 42
The Waste and Uselessness of Air Races 46

Copyright, 1936
ZIFF-DAVIS PUBLISHING COMPANY

POPULAR AVIATION, Volume 19, Number 4, October, 1936. Published monthly by Ziff-Davis Publishing Company, at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor; Swanee Taylor, Associate Editor. New York Office, 381 Fourth Ave., New York City. Subscription $2.50 per year, single copies, 25 cents; foreign postage, $1.00 per year extra. Contributors are especially advised to retain copy of their contributions, which must be accompanied by return postage. All such material will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for copy used will be made at our current rates. Photos and drawings will be considered as constituting a part of the manuscript in making payment unless otherwise specified. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879.

XUM

The Unbelievable Truth About



This shows the actual landing being made by Max Karant. It is the same ship with Max inside at the controls—not simply a picture of the ship.

by MAX KARANT

who, without previous piloting experience, flew the maligned pet of the Bureau of Air Commerce.

CRITICASTERS, human termites who always seem to infest an industry whose very livelihood is progress, now are attempting to destroy the possibility that some day the air-minded man on the street may be enabled to own and operate his own safe, economical airplane with as much ease as he does his automobile today.

Webster describes a criticaster thus: "An inferior or contemptible critic."

America's aviation industry, since its inception 33 years ago, has been materially hampered by men who, having the gall to describe themselves to a gullible public as "authorities", have condemned, insulted and mocked the efforts of a few quiet, farsighted airmen who have sought to improve upon the present-day product. Orville and Wilbur Wright were called lunatics because they were unfortunate enough to announce publicly that their frail kite could fly under its own power and carry a man to boot.

It seems sad that today, despite aviation's zoom to the importance of a major world industry in a meager 33 years, critics whose entire claim to authority is based on ignorance and prejudice should be allowed to voice their chronic condemnations in the public prints of this country and by word of mouth.

Let's get down to brass tacks. We'll use the attempt of the Bureau of Air Commerce to produce a safer sportsman's airplane as our current example. Two years ago, Eugene Vidal, director of the Bureau of Air Commerce sent a questionnaire through the mails to all private pilots in the United States. Among the questions Vidal asked was one something like this:

"Would you buy an airplane if you could get one that was safer, cost something like $700 new and could be operated as economically as your automobile today?"

Plenty of amateur pilots sent back their answer: YES!

But a piece of candy will draw the flies as surely as it will a hungry child.

There are a certain number of "victims of circumstances" who hold important jobs in the aviation industry and who, by buying large amounts of advertising in certain trade papers, have at their disposal a few self-styled authoritative writers who would just as soon slit Mr. Vidal's throat with their literary knife as give the latter credit for producing a product beneficial to the industry. That, sad to say, is the situation today.

Vidal, a pilot himself, had some time ago come to the apparently astonishing conclusion that the amateur airman was actually taking his life in his hands if he dared defy the laws of gravity with anything less than five hours of dual (expensive) instruction.

Amateur or sportsman flying today is dangerous. The manufacturers of sportplanes can extoll the virtues of their products until kingdom come; amateur flying today *is* dangerous. Insurance companies proceed with caution when they run across an amateur pilot.

Yet, what have the manufacturers of these present-day sportplanes done to preserve the lives of their customers—the few hundred today and tomorrow's thousands? Well, the latest ships are pretty slick examples of streamlining. But will an N.A.C.A. cowling keep a pilot from bashing out his brains on the instrument panel if he suddenly noses over in a landing? Will a gayly upholstered cabin keep a pilot and three passengers from getting mangled should that pilot err and stall close to the ground?

I'll use myself for an example. All my flying is strictly on airlines. Simply because American airlines are the safest means of flying known today. But I have always wanted to fly my own airplane and therefore am a prospective customer. But builders of standard type planes could never claim me as a customer.

There are two reasons for that. First, I can't afford any of them. Second, I'm honestly afraid of them. I couldn't fly any one of them without going through an intensive flight course and I'd have to be awfully careful that I didn't break my neck from then on.

Oh, there are hundreds of pilots who will snort at this and call me yellow. Well, perhaps I am yellow but, you authorities, can you deny the fact that there are thousands of young Americans today who think as I do; and every one

And here we have the Hammond self-stable plane flown by Mr. Karant. "They laughed when I sat down to fly," quoth Mr. Karant, "but they can't laugh off the fact that I performed all ordinary maneuvers without training."

Hammond's Experimental Plane

of them a potential customer for the flying product that meets their needs?

The sport airplane today has changed only superficially from the original Wright brothers' kite. About all the present-day manufacturer can boast about are non-spinning qualities and long range, more performance and comfort. A cross-wind landing still is just as liable to roll a ship up in a ball as not. Or a ground loop. Or a forced landing in a small lot. In other words, the manufacturer has done little except "soup up" his old product and keep reselling it. The safety angle is soft-pedaled.

POPULAR AVIATION and I have criticized the Bureau of Air Commerce on various occasions and still do today. But, unless one is bribed to do so or is just downright ignorant, a person can't possibly brand a man a parasite who dares to suggest that he would like to see a safer airplane for the private owner. That's sheer hypocrisy and a distinct menace to the progress of American aeronautics.

It was more than 300 years ago that Francis Bacon said:

"That which man altereth not for the better, Time, the Great Innovator, altereth for the worse."

That age-old saying applies as much today as it did three hundred years ago. Statistics show that private flying has dropped off steadily since 1929 and signs of it picking up are few today.

When Eugene Vidal sent out that questionnaire he unwitttingly started a mud-slinging campaign that has made the Bureau of Air Commerce the most hounded, openly insulted body of aviation men in this country today. It seems his mistake was in mentioning the figure "$700". Hostile manufacturers, refusing to cooperate and perfect new safety ideas beneficial to themselves, after all, pounced on that price and flooded the industry with "scare" tales of how the "sly government men are attempting to steal our rightful heritage, American liberty, and compete with private industry". (Followed by a blare of bugles and a stirring crash of drums.)

In the face of this criticism, Vidal and his newly formed development section went ahead and issued specifications of their ideas and called for bids. Not one of the United States' more prominent manufacturers submitted a bid. Finally, small companies got contracts for a number of projects ranging from automobile engine conversions through various simplified types of construction, new inventions and hitherto undreamed of flight characteristics.

The Bureau of Air Commerce has everything against it in this battle. First, it's overrun with politics. Second, monetary appropriations for the new developments have totaled a comparatively meager $200,000. The government appropriated only 6/10 of 1 per cent of its 1936-1937 budget for everything coming under the head of science. Only a small fraction of that is for research work.

Third, unlike a private concern, it can't fight back. After all, these criticasters are taxpayers (unless they happen to be aliens). Simply, you can't bite the hand that feeds you, dirty as it may be.

What seems so difficult to understand, however, is why some of those critics can't see things as they are. It's only natural for selfish, self-satisfied companies to condemn something that may be a decided improvement on their product. It's much easier—and more profitable—for them to run along in their little rut and charge their limited number of buyers more than seven times the price of a popular automobile for a popular airplane. Before the automobile was developed to its present stage by research, however, a small sedan used to cost a small fortune. Today, according to Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, an automobile costs less per pound than pork or butter!

Dr. Compton, reporting on other industries that answered a survey pertaining to their costs and returns from research, writes that a majority of firms reported a return of 5 to 1 on their investment. Some reported 100 to 1 returns; a few, 1,000 to 1. In all cases, however, their progress always paid.

If research in other industries can increase their business a hundred fold why shouldn't this be true with the manufacturer of the sport airplane? Why can't the airplane manufacturer strive to perfect his or a new product to the

Max Karant (Right) just before his momentous flight. Max, you must know, is not even a student pilot, hence the worried look.

Three-quarter front view of the Hammond flown by Mr. Karant.

point where he can approach the huge untapped market that awaits him?

This market isn't a colorful dream. A poll of POPULAR AVIATION readers alone recently showed that there are 11,405 of them who are interested in purchasing an airplane within the next two years.

I have been forced to listen to the ravings of "authorities" whose sole occupation seems to be the accumulation of swivel-chair sores and the prevention of bottle rings on desk tops. Anyone in the aviation industry, for that matter, has read the attempts of certain gotta-fill-so-much-space-this-month writers. Some of those Bureau of Air Commerce condemnations I read finally caused me to wonder whether any living group of men could possibly be such blackguards and ignoramuses. That's where the critics have made their mistake. They've said too much for their own good.

For some time recently I had wondered about the Bureau's development project and just how terrible it was. I had word-pictures of red-eyed drooling monsters roaming the halls of the Department of Commerce building in Washington, each of them plotting a different way of taking the sport plane business away from the manufacturer.

Naturally I shied somewhat when a Bureau of Air Commerce official, probably suggesting it to me because I had not as yet gone out of my way to crucify the Bureau in print, invited me to visit Washington and see for myself what results had been obtained to date. The Bureau official also added a statement that almost inclined me to believe some of the criticasters. He calmly told me I could fly one of the new ships recently delivered to the Bureau—the Hammond "Y".

What made me give him a startled look was the fact that he knew perfectly well that I am not a pilot of any sort and never have held even a student's permit. Actually, I never have landed or taken off a conventional airplane. Yet, he insisted I could fly the ship!

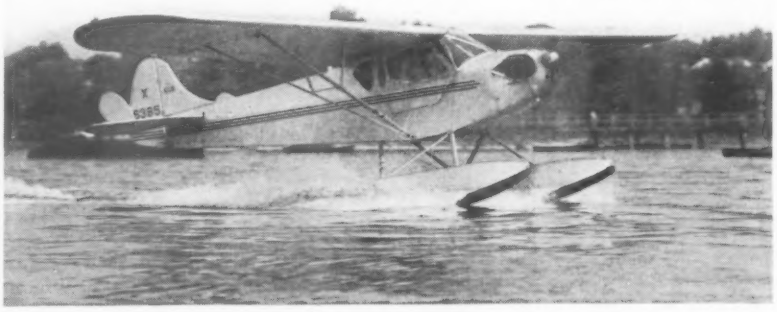
Instead of heeding the impulse to laugh in his face, I warned him I'd probably accept his invitation and visit Washington to see for myself. Still he didn't back down.

On July 13 I was aboard a Washington-bound Douglas American Airliner determined to settle the entire mess in my mind once and for all. Early the following morning I was at Bolling field with John H. Geisse, chief of the Bureau's development section.

There on the runway stood a three-wheeled ungainly looking affair with engine idling. It was the first of an order for five of these experimental ships placed with a small Michigan manufacturer who now has moved to California. He is Dean B. Hammond who, with Lloyd Stearman famed airplane manufacturer, will complete the Bureau's order. Hammond had built a

(*Continued on page 56*)

Two New Seaplane Jobs—A Cub and Stinson



A Taylor Cub Type J-2 taking off on Edo Type 1070 floats. The lightplaners are taking to the water in large numbers.

THIS YEAR has witnessed greater interest in the construction of light seaplanes and an increasing number of private pilots have been sold on the idea of water take-offs.

There are a great number of advantages in owning a seaplane or a landplane that can be converted into a seaplane, in cases where the owner lives near a large lake or river. Water surfaces are always level, and usually smooth for one thing, and even on small lakes there are seldom obstructions of any kind to endanger landings or take-offs. The lakes or rivers are easily recognized from a distance and the whole problem of amateur flying is simplified by the use of seaplanes.

While it is true that most of our readers have seen Taylor Cubs equipped as landplanes, yet the Cub has only become nautically inclined during the past few months. The Cub seaplane, Type J-2 shown here, has been licensed and approved when equipped with Edo Model 1070 pontoons.

The Cub J-2 has proved to be a satisfactory little seaplane, full load take-offs on smooth glassy water generally being made in about 30 seconds. The speed in the air and general handling characteristics have not been changed.

Itemized, the load consists of empty weight, 552 pounds, useful load, 416 pounds, the latter consisting of full tanks of gasoline and oil, pilot, passenger and 14 pounds of baggage.

The other surprise is a sea-going Stinson Reliant, Model SR-8EM shown below, also on Edo floats. The specifications, with the exception of the floats, are the same as for the standard landplane. The addition of these floats should add much to the flying of the Reliant.

Home-builders are also feeling the urge of the times and we are witnessing various amateur attempts at seaplane design although the design and construction of the hulls has been a poser for many of them. At the present time there are several Heaths and Pietenpol adapted seaplanes which, however, have been provided with increased power to take care of the added weight of the pontoons.

The pontoons introduce a problem all by themselves that can only be solved satisfactorily by an engineer familiar with hydrodynamics or boat building. The matter of the proper displacement of the hulls, the contour of the water-planing surfaces and similar problems, make it highly desirable that the services of an experienced hull building concern be requisitioned.

And here we have a Stinson Reliant Model SR-8EM in a nautical mood with two pontoons.

Bleriot's Channel Crossing

Enthusiastic greeting will be extended to this story written by the "Father of the monoplane." His crossing of the English Channel, in its time, created as much interest as the later crossings of the Atlantic.*

by LOUIS BLERIOT

IN the twenty-five years following the first crossing of the English Channel, the oceans have been systematically crossed, one after the other, and the world has been encircled twice.

This is indeed a short space of time, if one considers the slowness with which progress was achieved a hundred years before. Twenty-five years were necessary before we could completely realize the conquest of the air, while several centuries were needed for us to pass from the old-fashioned stage coach to the modern car.

Well, this crossing of the English Channel, which was to be the first step in the conquest of the air, was not much of a story.

In 1909, aviation had already taken its place among the practical realities, and we had enough experience to attempt such a feat.

The facts are well known. There were three contestants for the prize offered by the "Daily Mail": Latham, on his "Antoinette"; Count de Lambert, on a machine built by the Wright brothers; and myself, piloting my Bleriot, No. 11. Actually Count de Lambert was never really in the running and Latham was my only rival.

With the help of three workmen, I had my machine all ready and was patiently waiting for favorable conditions to take to the air. After Latham failed on two attempts, I decided to take off. I had no special compass and meteorology was not as organized as it is today, when aviators are furnished with useful information. I guided myself by sight.

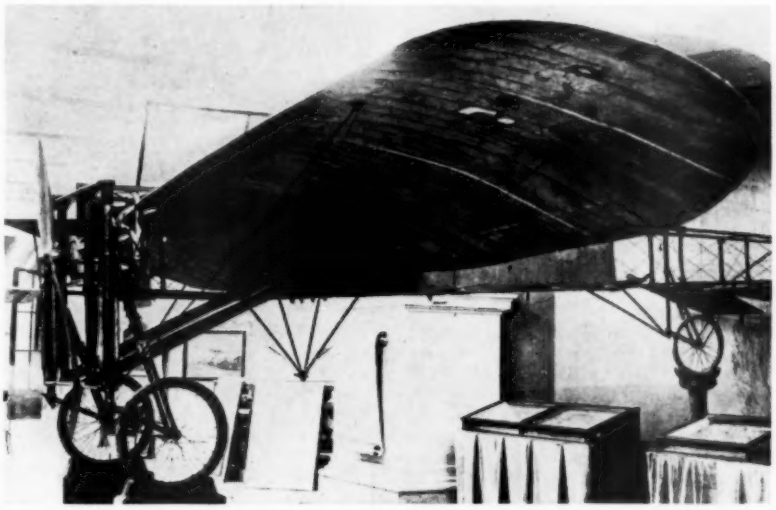
I truly only had ten troublesome minutes, when, after losing the French coast from sight and not having yet perceived the English shores, I found myself between the sky and the water. Caught in the mist, I was thrown quite a bit off my course to the north of Dover, which made me make a wide turn in order to find my normal route again.

If I had fallen into the sea, I certainly wouldn't have been able to get out, for I had been injured a few weeks earlier at Douai, and I was still walking on crutches. The government had put at Latham's disposal two torpedo-boats and when I decided to leave, Latham lent me one of the boats. Unfortunately, the latter was going 30 kilometers an hour, while I was hitting 70, and I very quickly lost sight of it.

What I shall never forget is that most hearty and most cordial welcome I received in England, and the pleasant feelings they have always shown me since that time. Four years ago, on the twentieth anniversary of my flight, a monument was erected through the efforts of Mr. Dekker on the spot where I landed, and for next July 25, I have been invited by my friends Baron Hawker and Lord Thomson, to celebrate the silver wedding of the crossing of the English Channel. I am happy that I can thus establish a cordial bridge between our two countries.

I confess that I am proud that it was with a machine of the same construction as the one with which I crossed the Channel, a shrouded monoplane with the motor in the bow, that Rossi and Codos succeeded in accomplishing that Paris to New York flight. This constitutes the greatest air journey realized with a

*Via Black Star.



The Bleriot Type XI Cross-Channel monoplane, the type used by Bleriot in making his historic cross-channel flight.

THIS article, probably the last written by the late Louis Bleriot, is filled with interesting notes on his historic "cross-channel" flight that, 27 years ago, was comparable to Lindbergh's Atlantic Ocean crossing.

Bleriot, who was a wealthy automobile accessory manufacturer in France, spent much of his money and time in aeronautic experimental and research work. The Bleriot "Cross-Channel" Type XI monoplane shown here, was copied and built by amateurs all over the world.

Louis Bleriot and his wife (in the foreground), just after his successful flight across the English Channel.

load of gas representing 2,000 kilograms in weight. With this same machine, Bossoutrot and Rossi achieved the distance record for a straight line, with 10,601 kilometers.

At present, the possibilities for aviation are innumerable. There are three records to show the progress that has been accomplished up to now. The record for altitude, which is the most difficult, but most promising, for flying to a high altitude presents questions the solution of which may upset present conceptions; the record for speed, the most sporting and the most dangerous; and the record for distance, the most technical and the most practical.

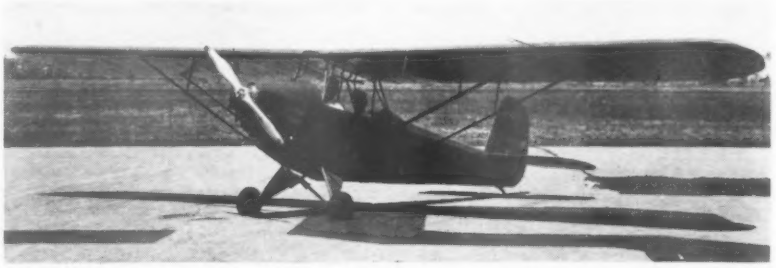
The first two of these records belong to Italy, the third to France. In order to establish these records, special machines are constructed. From the studies that are necessary in order to build them and from the comparison of the results obtained, there spring forth important ideas serving to improve the manufacturing of commercial machines. Therein lie the essential interest of these exploits and of the battle that aviators of different countries are waging with each other. As a result, nations will soon find themselves one beside the other on technical plans.

It is my opinion that the type of airplanes such as we have them today, should not be changed. For all land flights the type of machine with wheels will always be used, and for sea flights, the hydroplane. And for mixed flights on land and sea, which are more important and which will become even more extensive, the only possible machine will be the seaplane, that is to say a landplane with wheels but whose hull will be water-tight, to allow it to place itself

(*Concluded on page* 60)

A recent photo of Louis Bleriot beside a modern plane.

A New Member of the Porterfield Family



Here's the open model of the Porterfield "Zephyr", a substantial lightplane for a reasonable price.

ALL of our readers are familiar with the standard Porterfield cabin job which has aroused so much admiration for its fine appearance and performance, and now we witness the addition to the line of the Porterfield products, known as the "Zephyr" plane.

The little ship shown above is furnished both as an open cockpit or cabin model and sells for $1295 list. It has been thoroughly tested and highly praised by the several competent pilots who have flown it.

As will be seen, it is of the popular parasol type, amply strong for rough landings and provided with very efficient shock-absorbers. Its low price should make it popular with young men who wish to run up time for a transport pilot's license.

Eddie Rickenbacker Discusses War Planes

Eighteen years ago Eddie Rickenbacker said:

"A pilot's business is to shoot down enemies. Fighting in the air is scientific murder."

Shortly before these lines were turned over to the linotype machines, Eddie told your correspondent that he is still of the same opinion. He asserted this so vigorously that your faithful reporter begs you to observe that here is a man who has not permitted civilian life to dull his appreciation of the truth:

Air fighting is a grim business.

That the lessons of the war were well learned by the redoubtable flyer is shown by his further statement to this reporter, revealing how abreast of the times he is. He said:

"Even 3,000 miles of ocean would be no safeguard against an attack from the air. Those two French flyers, Codos and Rossi, instead of dumping a ton and a half of gasoline to land their disabled ship, might have as easily dropped a ton and a half of poison gas, high explosives or disease bacteria. Such an attack would be perfectly feasible."

He sees the best days of the Atlantic ocean as a defense already at an end—should hostilities commence. He points out:

"Man power is the cheapest thing in a war. The enemy could come across the ocean, do his damage, then land and give himself up as a prisoner of war. All his country would lose would be an airplane and perhaps two or three men while our losses would be incalculable. That would be pretty hard to take."

Eddie still flies. It is doubtless fresh in your minds that he ferried a giant transport plane across the continent, taking with him the last mails before the U. S. Army Air Corps played postoffice for a while. So he's got to keep in the know.

Besides, here's what Eddie's been up to since he laid aside his uniform.

In 1928 he organized and became vice-president of the Rickenbacker Motor Corp., thus attracting the attention of the General Motors people. They made him an assistant general sales manager and it wasn't long before he was transferred to the Fokker Aircraft Corp., as vice-president and director of sales.

At present much of his time is taken up with the affairs of American Airways. As vice-president of North American Aviation, he helps guide the destinies of its subsidiaries, Eastern Air Lines, Inc., TWA, Inc., and General Air Lines, Inc. When he fills his spare time it is often with his duties as contest chairman for the American Automobile Assn., and as president of the Indianapolis Motor Speedway Corp.

Tucked away some place are a D. S. C. with 9 palms; a Congressional Medal of Honor; a Legion of Honor; and a Croix de Guerre, 4 palms,—to name a few. But he doesn't give much thought to these mementos. Modern aviation—aviation in America today is his greatest concern and liveliest interest. He tells your anxious reporter:

"Unquestionably American aviation is the most advanced in the world today!"

Rather encouraging, isn't it?

He continues:

"Alarmists and badly informed outsiders claim we are behind this or that foreign nation in developments of aircraft.

"The truth of the matter is that the whole world comes to us to buy patent rights on our improvements. People don't

(*Concluded on page* 64)

Military Aviation in Japan

The rapid development of Japanese aviation has many interesting angles. Our correspondent, well qualified to discuss such matters, gives a concise account of this development in the following article.

by N. MATSUMURA

JAPANESE army fighters now on the first line of national defense are all of home construction and home materials.

Nakajima built Army 91 type monoplanes which are air-cooled engine fighters and Kawasaki built Army 92 type biplanes which are water-cooled engine fighters and both are at present largely in military use. They are of light metal construction and equipped with war-time preparations.

Japanese army aviation dates from 1911, 15 years ago, when Henry Farman's biplane (Gnome 50 h.p.) from France and Grade monoplanem (25 h.p.) from Germany were introduced to Japan and public flight was demonstrated in December of the same year. Baron Major Tokugawa, the present principal of the Military Aviation School, is the very first army flyer who took part in this demonstration flight.

In the World War, one squadron of our army flying corps took active part in the storm over the Tsingtau fortress and one of our planes, a Nieuport monoplane (Gnome 100 h.p.), was loaded with a rifle in the observer's seat. Our planes, however, missed the chance of exchanging fire with German "Taube." "Taube" had already departed from Tsingtau and flown into the Chinese territory.

A few of our army flyers also joined in the battles in the Western and Italian Alpine fronts in the World War, and on their return they introduced in Japan Nieuport Scout, Spad and Sopwith, etc., all of them powerful fighters, and their splendid performances were publicly demonstrated.

In 1919 our army authorities decided to organize formally an army flying corps. They invited the French Air Mission, headed by Colonel Faure, and our army flyers received strict and important instructions from them and established the foundation on which the present powerful air force lies.

The first of the fighters adopted as equipment machines were a Nieuport Scout (L'Rhone 120 h.p.) and a Spad biplane (Hispano-Suiza 220 h.p.). Later, a Nieuport 29 C1 biplane was extensively used. This Nieuport biplane was in 1923 named and adopted as Army A 4 type fighter. One of this type of machine was first imported from France, but later its construction right was purchased and Nakajima and other aircraft works built and supplied it to the Army as an equipment machine. This type of fighter actively joined in the attack on the ground enemy in Shanghai and Manchurian disturbances.

In 1931 Nakajima built an all metal

(*Concluded on page 57*)

A Spad "13" given the Japanese numerals "C1" during 1919 and 1922. Equipped with a 220 H.P. Hispano-Suiza engine and capable of 129 M.P.H.

The "91" Nakajima built in 1931 with a 450 H.P. Jupiter installed which gives it a speed of 180 M.P.H.

The Kawasaki built in 1932 with a 500/600 B. M. W. engine.

Betty Snell—A Canadian Pilot

Meet Betty Snell, the plucky Canadian girl who flies with a special set of controls.

BETTY SNELL, a St. Thomas, Ontario, Canada, co-ed who has been completely paralyzed from the waist down since stricken with infantile paralysis in her babyhood, grew up facing problems that others happily avoid.

She has never been able to walk a step as long as she can remember, but seeing everything sunny side up, she thinks it great fun that at every move some boy friend must pick her up and carry her. Her lovely voice has made her a Canadian radio star and nobody among her listeners suspects Betty has any disabilities.

"Well, since I can't walk, I had better fly" she told her girl friend, Margaret Edgeworth. Together they drove to London, Ont., Airport and put the proposition to Capt. Tom Williams, Canadian wartime flyer who is now pilot instructor of the London Flying Club.

Williams rigged up a special set of controls, found Betty perhaps his aptest pupil. She passed stiff government tests to qualify for a private pilot's license, and is going on now for her commercial. Now Margaret is a pilot, too.

"My future is in aviation," Betty says. "I have learned to fly. Now I am out to reach the top. If I become a better pilot than somebody else I'll get the job; watch and see."

College Students Design "Dream Ship"

THE members of the Case Aero Club, Case School of Applied Science, Cleveland, Ohio, have recently completed the last wind-tunnel tests and stress analyses of a little machine in which they feel P. A. readers might be interested.

The tiny craft, known as the "Case Sub-Scout," is nine feet, seven and one-half inches in overall length, has a nineteen foot span and weighs four hundred and fifty pounds empty.

High speed estimate, from wind-tunnel determination is estimated at one hundred sixty-five m.p.h. Outboard floats are retractable.

The extremely small size, facilitating operation from a submarine as a base, is made possible by situating the pilot reclining, face downward. This attitude is bearable for about an hour and a half, the time taken for the ship to cover its maximum radius.

We wish it understood that this little plane is merely a speculative proposition and has never materialized further than a nineteen inch model.

A few more details . . . include all metal construction, Alclad skin, countersunk rivets. Motor: six cylinder opposed, Glycol cooled, 70 H.P. located in wing between spars, drives 4'3" prop throughout board shaft and bevel gears, fuel tanks in bottom of hold. Equipment: two way radio, water rudder, electric starter. Wing loading is rather high, six and one-quarter pounds per square foot, but this evil seems to be a necessary one where size is such a determining factor. Wing is demountable.

It is believed that this design will meet with all expectations and will show the predicted performance. There seems to be no reason why it should not.

An Instrument Illuminator

A NEW "Moon Glow" type aircraft instrument illuminator and map light is announced by the Fairchild Aerial Camera Corporation. The illuminator is only 3¾ inches long and has a diameter of but ⅞ of an inch. Current consumption is ¼ ampere per unit at 12 volts. The metal shell of the device is fitted with a knurled ring at the forward end by which the diaphragm, through which the light is projected, may be adjusted. The light bulb is mounted on a socket which fits into the rear end of the shell.

In the side of the shell is a window fitted with a sliding shutter which may be opened to light the cabin for reading maps or for general illumination. Between the bulb and the diaphragm is a light-collecting lens, and another lens is located at the forward end, for confining the beam to a definite area. This special optical system permits the perfect control of the beam shape on the panel.

If it is desired to confine the beam to a few instruments or a special group it is merely necessary to insert a correspondingly shaped mask at the focal plane of the projection lens. The most effective location for the device is above the head of the pilot on the center line of the airplane, with the forward end aimed at the instrument panel.

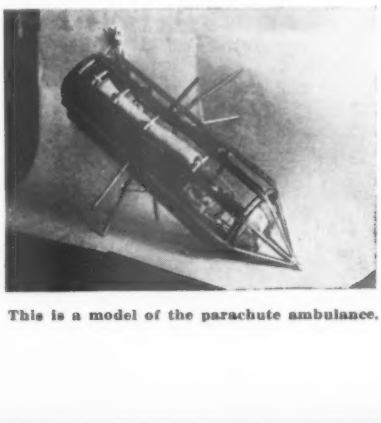
A Parachute Ambulance

ARMY air corps workers in the equipment branch at Wright Field have developed a parachute ambulance for lowering helpless persons from a disabled airplane.

Following tests with the conventional litter, the inventors believe the standard army parachute adequate for the device, of which only a model has been built so far.

Essentially, the ambulance parachute consists, besides the 'chute, of a close-fitting cylindrical padded cage enclosing the conventional litter. The bottom of the cage is tapered, ending in a pointed rod intended to anchor in the ground on impact. Between the rod and the foot of the litter is a pneumatic shock absorber.

A series of spring rods resembling the ribs of an opened umbrella encircles the cage, to keep it from striking the ground flat and to reduce danger of dragging.



This is a model of the parachute ambulance.

"....Clear and Unlimited"

Our versatile commentator, in his highly interesting and entertaining manner, makes pertinent remarks concerning doers and doings in aviation.

by SWANEE TAYLOR

Foolproof Foolhardiness . . .

WELL, somebody's gone and pressed the middle valve down again!

Once more, Gene (Ole Halfback) Vidal is going 'round and 'round with his $700 foolproof airplane dissonance. And you can bet all the cotton in Dixie, friends, it'll continue to come out blaaaaah.

Why, you ask, won't Vidal's tiresome *fugue*—look it up, pals—ever get anywhere? And I'm quick to remark, chumsy-wumsies, thatta itsa lika thisa: The Ole Halfback is taking the same baby experimental steps, aeronautically, which Octave Chanute, Otto Lilienthal, Dr. Alexander Graham Bell and even Leonardo da Vinci walked-off years and years and years ago.

The trouble is, he doesn't know his aviation history; his is a blunder spawned either of misconception or out-and-out ignorance. (Something the current administration will have to live down to the undiluted merriment of every schoolboy who has progressed past the third grade).

Lordy me, every kid in the land knows that what we need today is a motor—a snappy little job of about 65-75 horsepower. And I wouldn't be at all startled to see somebody like United Aircraft come out with one before Spring rolls around again.

Meantime, I suppose, Ole Halfback will keep on puttering around with his foolproof plane idea. But, shipmates, although they may eventually build them foolproof, they'll never be able to make 'em damn-foolproof. And by the same token, they will never be able to manufacture an airplane so's to keep ten-year-old children from being sent solo.

* * *

A Pilot Dies in an Airplane . . .

> *"When I first saw the plane it was circling very low. . . . So low as he passed me that he hit two tall trees and knocked leaves from them."*—Airplane crash story in a newspaper.

In that ship, m'lords and ladies, sat a passenger who throughout every fraction of those horrible last seconds, realized exactly what was taking place; he recognized every mistake, every error in judgment, every managerial fallacy which always combine to send a ship load of human cargo smash. And, oh dear God, all he could do was sit there and sweat, utterly unable to do a thing.

He had no chance, alas, to die fighting for the lives of everybody in the ship. You see, he was a licensed airplane pilot, one who had flown long and exceedingly well—just sitting there in the luxuriously appointed cabin, his feet itching for a rudder-bar.

SWANEE TAYLOR, looking out at you from above, has certain ideas on Bureau activities that are somewhat at variance with Max Karant's actual experience, and the National Air Board shares Mr. Taylor's opinion. Well, time will tell.

What a galling ride to Valhalla it must have been; the trapped helplessness of it all! At one moment he lounged in his seat in a state of gently relaxed vigilance common to pilots, then, in a trice, all his senses were called to arms as things started to happen. It may have been motors, it may have been some tiny indication of structural failure or it may have been merely that the pilot decided to turn back to have his radio fixed. Whatever it was, we can be certain that every nerve filament in his body quivered in the white heat of alert apprehension.

Among other things, he knew only too well that the ship was much to low for safety. And his hands doubtless flexed subconsciously to pull her up for some life-saving altitude. As things rapidly went from bad to worse we can see him with his mind clear as a bell and functioning with calm swiftness:

Get up, fellow, get up . . . get on up . . . we'll get her back down all right! . . . Easy now, don't bank around so close to the ground . . . take it easy. . . . Get that wing up! . . . What in hell is the matter with you? Get some altitude, fool, before you crack-up. . . . Geez, you're smack in the trees . . . wanna kill us all? . . . Flare. Drop a flare and land straight ahead. . . . Cut the gun . . . straight ahead . . . land her before she lands you! . . . Holy mackerel, here we go! . . . SWITCHES!!!!!

Eternity.

Ah, how well I know the feeling—all, of course, save the crash. Once upon a time an airplane pilot took me on a moonlight ride so damn low the shadow of the ship was clearly visible on the ground. Which means that he was far below two thousand feet. And just to make it real ducky, we had a tail wind and the right hand engine sounded like a rock crusher. Had it been necessary to land (they still quit at times, dear hostesses), we more than likely would have hooked a wing in a tree or something. There simply just wasn't room to make a 180 degree turn into the wind without full power.

The pay-off came with the management's condonance of low flying on a night when the moon shone bright as a silver dollar. How little Audrey laughed and laughed when she heard about it. Because she knew that the big safe airliner always flys high enough. The trouble is that the ground comes up higher above sea level at certain places than it does at the terminals. (I've got the correspondence to prove it.)

Such, I fear, will be little Audrey's excuse for the crack-up outside St. Louis; the ground came up higher above sea level. Just that. Only it came up so suddenly as to kill eight people.

Among those eight was Vernon Omlie, the pilot who had flown so long and exceedingly well. How Aviation is going to miss that man! His loss is a crushing blow to our Beloved Flying; he should have been spared us.

Vernon Omlie's contribution to flying, in case you don't know, is equal to that of any one individual. Not to say considerably greater than that of all the ocean flyers combined. To him, and his wife Phoebe, goes every ounce of credit that the mid-South today is rabidly air enthusiastic. They barnstormed throughout that section carrying the aeronautical banner with great and lasting effectiveness. And if the Tennessee bloc in Congress doesn't hasten to pay belated tribute to Vernon's heroic flood rescue work, back when the Mississippi used to go on periodic rampages, then that bloc might just as well be chopped up into kindling wood.

While they're about it, they might just as well hand Phoebe Omlie a Distinguished Flying Cross, too. For she streaked out repeatedly across swirling muddy death on the same kind of mercy errands as Vernon. It was gallant work,

XUM

and typical of their very kindred spirits. May God rest him, and comfort her!

So long, Vernon Omlie . . . happy landings to you wherever you are. We'll be seein' ya.

* * *

Thumbnail Report . . .

(Being an imaginative report to the Board of Directors of the Looser-Longerons Aircraft & Motor Works Ltd., of Liverpill, La.)

GENTLEMEN, THE BOARD OF DIRECTORS: By way of preface, let me urge that this report of the state of your company should never reach the stockholders' eyes. For, individuals who invest their money in manufacturing stocks generally do so in the fond hope—sublime assurance—of making a quick, hale and hearty profit. And although dividends may be passed for lengthy periods, profitable stock fluctuations will never be assured as long as company operations remain muddled and static. The suckers may sell, but they'll never buy again.

Our report, merry sirs, will be made in three instalments; viz., management, production and sales, in the order named. But before proceeding with the subject management, it is but fair to say that in the production phase only, is there the slightest semblance of modern business methods in Looser-Longerons Ltd.

MANAGEMENT

A thoroughgoing reorganization is needed in the executive branches of Looser-Longerons Ltd. Practically all of the company ills, including stockholder starvation, is directly traceable to a snobbish outlook on the business of corporate living.

Not only is the present management short-sighted and parsimonious in the military equipment and the motors divisions, but the same sad state obtains in the civil aircraft department. It is understandable how the former have dropped into a rut of high-mindedness. These officials are thrown constantly into contact with outrageous Jingoism, which is highly contagious. But the utter disregard both voiced and demonstrated your civil aircraft people is unponderable.

All signs of the day point undeniably to a national awakening to aeronautics. Already there are some 43,000 fliers in this country including student pilots. Yet Motors and Civil Aircraft steadfastly refuse to look ahead beyond the current week. Motors can't be bothered with anything less than 1,000 h.p., and are content to limp along on legislated small profits from the military services. They seem to be somewhat munitions makers at heart.

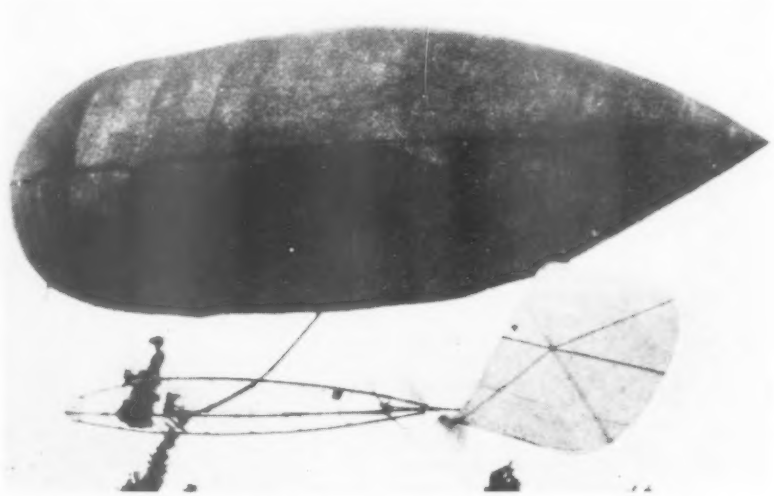
Similarly, Civil Aircraft is unconcerned about the stockholders. Not a man among them seems to know or care that 50% of the commercial ships sold last year were types in the low priced class. And if anybody in the company knows or cares that Henry Ford made roughly a billion dollars in 33 years supplying the world with low cost personal transportation, he hides his concern with a rare, masterful secretiveness.

Nothing, it must be repeated, can be

(*Concluded on page 69*)

Blimping in the Early Days Was—Something

by HENRY SOUTTER



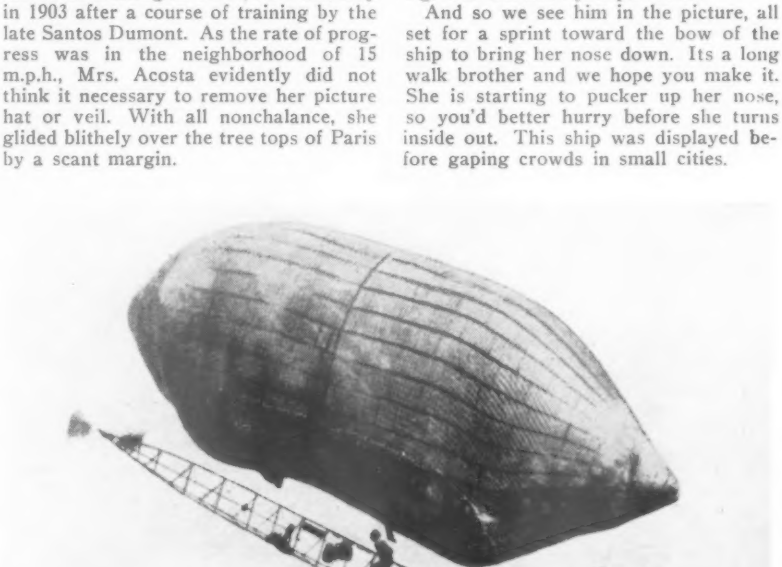
You will see Madame Breckinridge up in the prow of Santos Dumont's ship, picture hat and all the feminine fixin's. She is making quite stately progress over the tree tops as we can jolly well see.

WHEN Santos Dumont, the Brazilian, first circled the Eiffel Tower in Paris, with his dirigible, he electrified the world with his daring. However, the fact that a woman also flew this same ship, shortly after the Eiffel Tower event, has seldom been published.

To make a long matter short, Mrs. Aida de Acosta Breckinridge, an American woman living in Paris, flew this ship in 1903 after a course of training by the late Santos Dumont. As the rate of progress was in the neighborhood of 15 m.p.h., Mrs. Acosta evidently did not think it necessary to remove her picture hat or veil. With all nonchalance, she glided blithely over the tree tops of Paris by a scant margin.

About four years later, Mr. Charles Baysdorfer of Cleveland, Ohio, contracted the blimp fever and bought unto himself a Baldwin dirigible which he called the "Comet." As with all of Cap Baldwin's 1907 Mickleberries, longitudinal equilibrium was attained by the simple expedient of the pilot running back and forth along the fuselage until the desired c.g. was located by experiment.

And so we see him in the picture, all set for a sprint toward the bow of the ship to bring her nose down. Its a long walk brother and we hope you make it. She is starting to pucker up her nose, so you'd better hurry before she turns inside out. This ship was displayed before gaping crowds in small cities.



And now, we have with us, the agile sprinter Charles Baysdorfer who combines gymnastics with his aviation as set forth above.

Proposed Altitude Rocket Hops

If present plans succeed, there may be a series of high-power rocket flights made in the United States. American Rocket enthusiasts are working hard for the moral and financial support of our citizens.

by C. W. McNASH

A SERIES of rocket altitude shots —the first of their kind in this country—is planned by Mr. Willy Ley, former associate of the famed Professor Oberth, pioneer rocket theorist.

The rockets will be "one-stick-repulsors", a type developed by Mr. Ley and a European rocket society after about four years of work on the society's rocket airdrome. This type of rocket is highly favored in Europe because of its stability resulting from the location of the motor at the nose of the ship, so that it pulls rather than pushes, the fuel tanks and instrument compartments.

In the one-stick-repulsor designed by Mr. Ley, the order of the parts is as follows, starting at the nose of the rocket:

First the rocket motor itself, supported by a fork of U-channel material. The fuel lines of course lead through this channel material. About three feet behind the motor (at a safe distance to be out of the way of the hot exhaust gases) will be the fuel tanks, both tanks tubular and in one line. Together these will be eight feet long and behind these tanks will be a two-and-a-half foot section consisting of compartments to house the instruments and parachute.

Cooling, always a problem in rocketry, will be accomplished without a special cooling system, as this would add much weight. Sufficient cooling will be obtained by mixing water in the fuel or by spraying a small quantity into the chamber. The motor will deliver approximately 85 pounds thrust, and will be fashioned from refractory heavy alloys.

Mr. Ley's first rocket shot will ascend to a height of approximately 10,500 feet, launched from sea-level. The promise of complete success is very great, as this experiment will be almost identical to others which he made while in Europe.

Following completion of the 10,500 foot ascent, Mr. Ley plans construction of another one-stick-repulsor designed to ascend 26,500 feet if launched from sea-level, but it is highly probable that this rocket will be started from an elevation of about three miles, so that the rocket will be launched in rarefied air and will ascend to a total height of about ten miles above sea-level.

In both of these designs the rocket shells will be lowered gently to earth by means of a parachute. While descending, the instruments will be close to the parachute, but the rocket shell itself will dangle, by means of a rope, not less than thirty feet below the instruments, so that the shell will touch the earth first, thus relieving the parachute of its weight and assuring a gentle landing for the instruments.

According to Mr. Ley, who has just completed a book, in English, on Rocketry (The Attack on the Stratosphere), development in rocketry will take place in three steps. First will come what he calls the meteorological or "weather" rocket, intended to pierce the stratosphere to heights of twenty or thirty miles and which would return with scientific data of great meteorological interest.

Next will come the "mail rocket," which would attain terrific speeds in the rarefied stratosphere and would be used

Willy Ley, prominent rocket engineer with extensive rocket experience, who is endeavoring to interest Americans in the science of rocketry.

to deliver mail across continents or oceans in less than an hour.

The third step in rocketry, as outlined by Mr. Ley, would of course be the space rocket—far in the future, perhaps, but sure to come, bearing with it staggering possibilities.

"The weather rocket," says Mr. Ley, "is, however, an immediate possibility. It's development to practical use is a matter of not more than a year's work and of less an expenditure of money than the price of a large passenger airplane."

Willy Ley, whose profession is science writer for American, British, German, French, and Swiss publications, first became interested in rocketry through his acquaintance in 1926 with Professor Oberth's theoretical work on rockets.

Soon afterwards Ley wrote "The Trip Into Space," which was a popular account of rocket theory. In 1928 he met Oberth at the annual meeting of the Scientific Society for Aeronautics and later the same year published his book, "The Possibility of Space Travel".

It was this book which inspired Thea von Harbou to write her novel, "The Girl in the Moon", which later was made into a film and stirred great interest in rocketry in Europe. Professor Oberth and Willy Ley supervised the picture and Ley also handled the scientific publicity.

Meanwhile, however, the European Rocket Society had been formed by Max Valier and Johannes Winkler in 1927, shortly after Valier had interested Fritz von Opel, automobile manufacturer, in rocketry and had conducted his famous rocket-car experiments. In 1929 Oberth became president of the Society and Mr. Ley became vice-president.

About this time the UFA film company was persuaded to finance experiments in rocketry, because of the publicity value for the film, "The Girl in the Moon". An altitude rocket shot was planned and Oberth and Ley set to work to develop a suitable liquid-fuel motor as it was decided that here was a splendid opportunity to put into practice the principles which they had been advocating in their writing. The boldness of the undertaking is appreciated when it is realized that as yet no liquid-fuel experiments had been made.

The first set-back was a psychological one. The "experts"—that is, the men who believed themselves to be experts on liquid-gases—informed the pioneers that mixing gasoline and liquid oxygen, as proposed by Ley and Oberth, could result only in the instantaneous freezing of the gasoline. This, they were told, would form a very dangerous and uncontrollable explosive.

Consequently, the first experiment was merely to conduct this stream of gasoline into an iron bowl containing liquid air. The result was, not the terrific explosion which the experts had predicted, but instead merely a beautiful combustion of the combined liquids. According to Mr. Ley, another fact of vital importance was disclosed by this experiment. When a droplet of burning liquid is shot into liquid oxygen it "tears itself to pieces," in such a way that, broadly speaking, any amount of fuel may be burned in a given space and time.

Following this first elementary experiment the society designed what was the first real liquid-fuel rocket. This was called the *Kegelduce*, "cone-nozzle," which embodied the now familiar exhaust nozzle, combustion chamber, injection ports, and feed lines. On July 23, 1930, this motor burned for 90 seconds, delivering a constant recoil of about 7 kilograms.

XUM

After the experiments with the *Kegelduce* type of motor, the experimenters, at the suggestion of one of the workers, Rudolf Nebel, began work on the first of a series of "Miraks," these being very small, inexpensive rockets so named because they were considered to be the "Minimum Rocket"—the smallest possible rocket.

About this time Klaus Riedel, one of the Society's engineers, developed a new design which Mr. Ley named a "Repulsor"—the type with which Mr. Ley will conduct his present experiments. The first Repulsor, purposely built too heavy to avoid its loss, climbed to an altitude of about 200 feet.

Finding the Repulsor type greatly superior to the previous designs, the workers concentrated on the construction of a series of Repulsors which proved remarkably successful.

The work of the European Rocket Society continued from August, 1929, to June, 1933, when the experiments had to be abandoned for financial and other reasons. During this time Ley, Oberth, and their associates built two Miraks, one Oberth-rocket, more than thirty Repulsors, and six heavy rockets (which delivered thrusts amounting to about 210 kilograms, but which were not as efficient as the smaller rockets).

Following the disintegration of the European Rocket Society, Willy Ley came to America in 1935, accompanied by another rocket engineer, Mr. H. Scharfer, and conducted the Greenwood Lake rocket airplane experiments, backed by F. W. Kessler, of New York City. The acceleration produced by Mr. Ley's new-type rocket motor was so great as to cause structural failure.

Backing for the proposed altitude shots will probably be furnished by some commercial organization interested in the tremendous publicity value of rocket experimenting.

END.

Powell Crosley is an Air Fan

POWELL CROSLEY, Jr., has been an aviation fan for a long time, but he probably has gone further into the pursuit of his hobby than any other plane owner in this country.

In addition to his Northrop "Delta" plane, Mr. Crosley also owns two other ships, an 8-passenger Douglas "Dolphin" amphibian and a Waco cabin plane. Further, Mr. Crosley has a private airport at each of his four estates. This is airmindedness with a vengeance.

Just how Mr. Crosley has time to use three planes is hard to visualize for, beside being president of the Crosley Radio Corporation, he is owner of Radio Station WLW and the president of the Cincinnati National League Base Ball Club. All this should give him plenty to think about.

If this should come to his attention, the writer would be glad to know whether he remembers the radio blueprint supplement in the now defunct Radio Age.

The Latest French "Flea" Activities

by CLAUDE COULANGES

Here is Henri Mignet seated in the latest "Flea", the Model HM-18, which has just been test-hopped.

DEVELOPMENT of the Flea is proceeding with great rapidity in France, under the capable hands of its designer and inventor, Henri Mignet. With Mignet, it is just one Flea after another, with notable improvements in each succeeding edition.

And now I have the honor to introduce the most recent addition to the Mignet family, the Model HM-18 which has just been completed and test-hopped. This model is a single-seater with a cabin, is bigger and is provided with more power than the earlier Fleas.

The HM-18 has a wing spread of 15 feet, weighs 250 pounds and is provided with a 38-horsepower engine. This larger power-plant gives the HM-18 a forward speed of 100 m.p.h., or slightly greater, and the Flea climbs to a height of 1,200 feet in two minutes. It has a cruising radius of approximately 400 miles.

It is interesting to note that this model flew perfectly, and without adjustment, the first time that it was flown which proves that Mignet is now the absolute master of his formula.

Two Famous French Bombing Chiefs

MOST of our readers have heard of Adjutant Leclerc who distinguished himself in the bombing division of the French air service. He is credited with 60 bombardments and nearly twice as many contacts with enemy aircraft.

With him is Adjutant Marseille who is credited with 97 bombardments, who distinguished himself at Friedrichshafen and Dieppe.

Adjutant Leclerc (left) with Adjutant Marseille just landed from a bombing mission, at Boissy, France.

French Lightplane Aviation

Miss Thomas, in her latest Paris letter to POPULAR AVIATION, discloses many interesting developments in the French lightplane situation. In France, the government views amateur activities favorably and not as crimes committed against the state.

by JOAN THOMAS

THE French are going in for *light aviation* in a big way. The prodigious amount of publicity that was given to the Pou-du-Ciel movement, created an intense interest in amateur construction and private flying, which has served to bring several other midget planes into the limelight.

There seem to be three different methods of trying to solve the problem of the "new aviation," as the French call it. First, there are those who insist that an entirely new formula must be developed. Mignet's "Flea" and Charles Fauvel's flying wing, the "sans queue," are examples of this idea.

The second group are working on the powered glider type. The best known of these over here are the S. F. A. N., the Leroy and the l'Avia-50. And last, the advocates of the classic formula (aileron and foot-control rudder) are building lightplanes such as the Potez-60 and the Farman "Mosquito."

Incidentally, the renewed enthusiasm for private flying has caused some of the large commercial companies to *return* to the problem, which they have ignored for several years, of building a ship that can meet the demand for a light, inexpensive machine. Nor is this the first time industry has been forced to compete with amateurs; the amazing history of radio may be duplicated in aviation and those who scoffed at the idea of a $700 plane will have to eat their words.

Farman, one of the oldest and most important of the French companies, built a special job for a lightplane competition back in 1924. They had never tried to develop this ship for commercial purposes, but the success of other lightplanes has convinced them that it might be revived.

Their 1936 "Mosquito" has a larger power-plant than the earlier model, otherwise it has essentially the same appearance—the same fuselage, landing gear and empennage. It is a single-place monoplane, with a span of 26′, overall length of 20′9″ and weighs 300 pounds empty.

The wings are strengthened by wire cables attached to the cabane strut above the fuselage and below, to the landing gear. It is powered by a 27-30 h.p. Ava motor, that will operate on two gallons of gas per hour. It has a maximum speed of 80 m.p.h., cruises at 65-70 m.p.h. and has a range of action of approximately 200 miles.

Recent tests made by the Farman test pilots show that the ship will take off within 200 feet and attain an altitude of 1200 feet in less than three minutes. It is possible to land the ship in 225 feet after passing over a 10 foot obstacle, which is less than one-third the distance allowed in the official specifications for a ship of this category.

The Fauvel "All-Wing" monoplane "l'Aile Volante" which has attracted much attention in France. This plane, and the "Flying Flea" represent the radical elements in the lightplane development.

However, the contrast between the ordinary, one might say old-fashioned, lines of the Farman "Mosquito" and Charles Fauvel's "sans queue" (without tail) challenges attention. And those who believe that a new technique must be developed think that the flight-characteristics of the two ships are as startlingly different as their appearance.

Fauvel, who has been working on the principle of the flying wing for the last eight years, believes that stability and almost automatic control are the two essential qualities in a plane for the private flyer. To accomplish this he has designed a ship that will neither spin nor stall, yet is extremely easy to handle under all conditions.

It is a neat little ship with large, triangular wings that give it the appearance of an overgrown butterfly. It has a span of 30′6″ and the maximum width of the wings is 11′4″, which gives it a total of 18 square meters of lifting surface. The comfortable fuselage has a two-place, side by side, seating arrangement and dual controls. Powered by a Pobjoy-R 75 h.p. motor, it cruises at 105-120 m.p.h. and lands at 30 m.p.h. It has a service ceiling of 21,000 feet and a radius of action corresponding to three hours of flight.

The official flight tests made by the Centre d'Essais de Materiel Aeronautique at Villacoubly, in the early part of this year, proved that the stubby little ship has perfect longitudinal as well as lateral stability. However, its chief distinction is the fact that it will not fall out of control even at stalling speed; it merely begins to settle or descends in a sort of flat spiral.

A somewhat similar lightplane, the "Arup" was built and flown in the United States sometime ago and numerous other attempts have been made along parallel lines in other countries, but the Fauvel plane seems to have met with greater public approval in France than this type of ship has been awarded in other countries.

Whether this will be the final type of lightplane is, of course, simply conjecture at the present time but it is entirely probable that the tailless plane will play some part in the aviation of the future.

Those who have felt that private flying could not develop until a new and *safe* type of ship was invented, are jubilant over the results of the official tests on the "sans queue." They believe that, since it is *easy to fly* and offers *security in the air*—the two essential qualities—and if it can be produced and put on the market at a low cost price, that it will be a worthy competitor in the race for public favor.

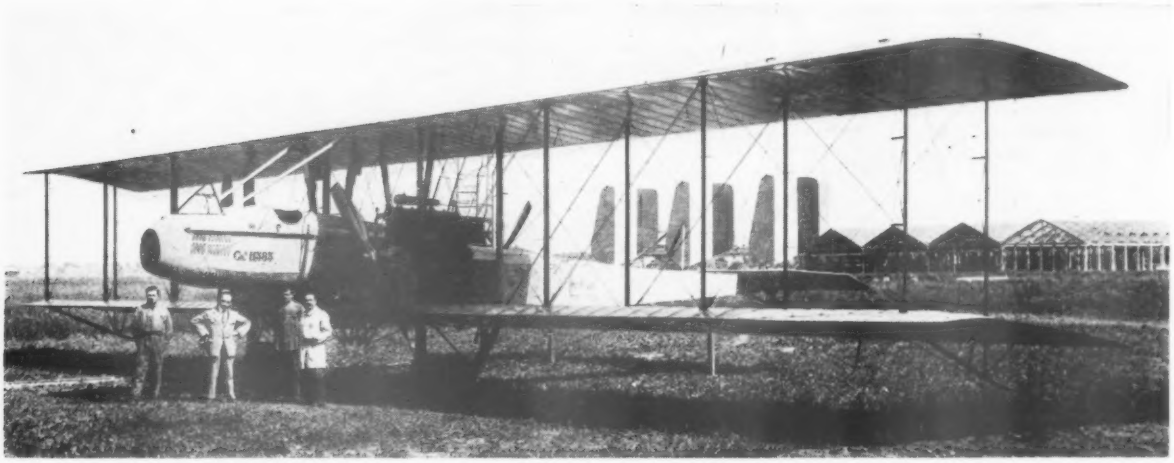
END.

XUM

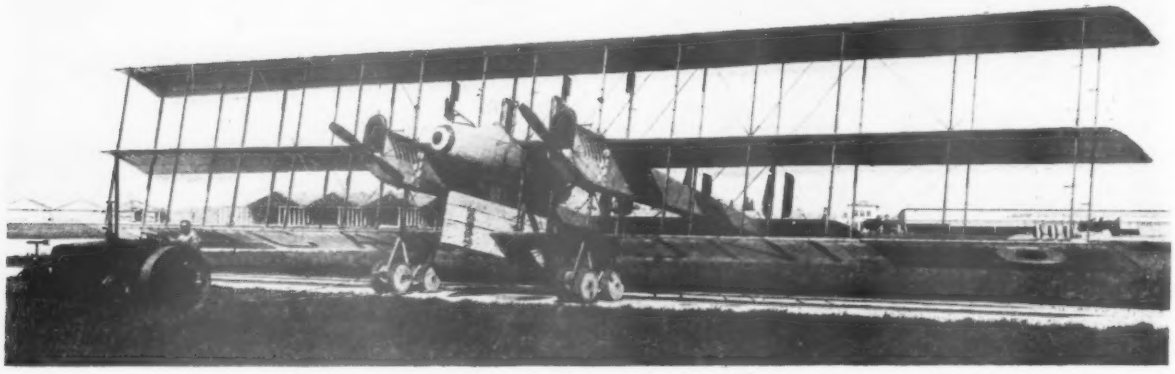
Still More World War Planes

The huge Caproni planes were distinctive features of the World War and paved the way for still larger ships to come. These photos are from the private collection of James Dimond, Chicago.

This twin-engined Caproni biplane Ca-33 was the first of the super-Caproni bombers. It is familiar to Americans as it patrolled a beat in Washington, D. C. during 1918. Note the triple rudders.



In the second edition of the Caproni biplane, there were sundry minor alterations in the nacelle but the triple rudder idea still persisted.



And here we have an excellent view of the famed Caproni triplane "41" equipped with power plants aggregating 900 horsepower.

Details of the Latest Lamberts

Renewed activities in the plant of the Lambert Aircraft Corporation, will prove of great interest in view of the new models now being produced. Mr. Kemp covers these new Lambert ships in great detail.

by BURTON KEMP

SHORTLY over a year ago only $20 rested in the treasury of the Monocoupe Corp. and the passing of Philip deCatesby Ball, its baseball-minded owner who was the guiding hand of the St. Louis Browns, left its financial status in quite a precarious position.

Into this void, however, stepped 33-year-old Clare W. Bunch, who purchased controlling interest in the company a short time later. Its name had then been changed to the Lambert Aircraft Corp. and thus did it remain.

Bunch worked unceasingly in the new company, serving in the capacities of president, general manager, engineer, and test pilot. The only planes then in production at all were the Monocoupe 90 and 90-A, its de-luxe sister ship. The latter was basically the same as the 90, but boasted extra equipment and a trifle more streamlining and speed. However, the 90-A was soon made into a very different airplane.

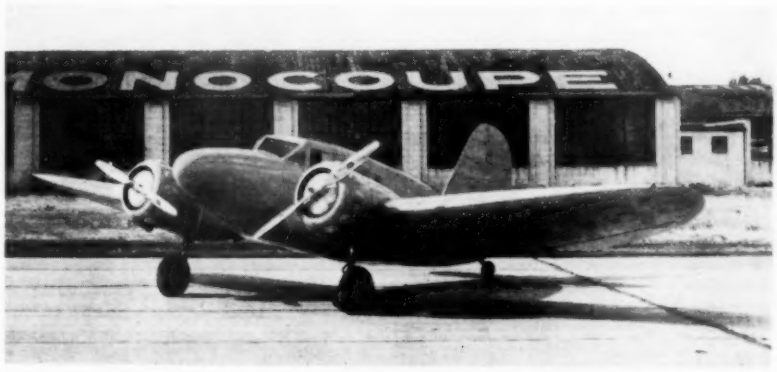
The most noticeable improvements were a new full cowling, wider and roomier cabin, flaps, wider landing gear tread, and other things which made the new ship one that immediately found favor with prospective buyers. As the orders began to flow in, production was stepped up and soon the plant was working at top production, turning out a ship a week.

Another thing that kept the factory going steadily was an order from the Bureau of Air Commerce for a number of Monocoupe D-145's, a plane that was developed especially for them. This is very similar to the 90-A, but is powered by a 145 HP. Warner Super-Scarab, whereas a 90 HP. Lambert R-266 is the power plant of the 90-A.

Only when this work was progressing steadily did Bunch turn to other designs. For a time the Michigan model 1

Lambert Twin Monocoach as viewed from the side.

Lambert Monosport "G" equipped with a Lambert 90-horsepower engine.



This new venture is the Lambert Twin Monocoach equipped with two 90-horsepower Lambert engines which is to invade the low-price twin-engine field.

was undergoing tests with an eye to purchasing the rights to its design and putting it into production; this is the all-metal plane that looks like a small version of the Vultee V-1A transport.

However, this plan was abandoned and the addition of Al W. Mooney to the staff of the company gave them an engineer who was one of the first to build planes that are so prevalent today, those of the low-wing type with a full-cantilever wing. He will be remembered for the Eaglerock Bullet, a four-place low-wing monoplane with a retractable landing gear, which made its appearance many long years ago.

Thus, it was only natural that a new plane of this type was produced. It is the Lambert G, which is made in two models, the Monoprep and Monosport. The former is an open-cockpit ship and is exactly like the Monosport which is pictured here, except for the fact that it does not have the enclosed cockpit which is faired into the fuselage. The Monosport also has additional instruments and other small details to make it an ideal plane for the sportsman pilot. The Monoprep is intended to be used primarily as a trainer and should be fine for this purpose because of the large area of its wing and tail surfaces.

The two models are the same in construction and all dimensions are similar. The fuselage is of welded steel tubing with fabric covering. The wing uses the N.A.C.A. 2315 airfoil section and two spruce spars carry the wooden beam-type ribs, which have double drag bracing wires in the structure. Fabric covering is also used here, as well as on the tail surfaces, which are full cantilever and fashioned of welded steel tubing.

A 90 HP. Lambert R-266 5-cylinder, radial, air-cooled engine is the power plant in both models. However, a wooden propeller and an anti-drag ring, as used on the Monoprep, are replaced with a Hamilton Standard propeller and a full N.A.C.A. cowling on the Monosport. The landing gear is of the fixed type and a leaf spring tail skid is used. Wheel pants give the Monosport a few additional mph.

The second and latest plane on whose design Bunch and Mooney have collaborated is the Lambert Twin Monocoach H, the first twin-engined plane to be built to meet the needs of the private flyer.

As this was written, the Monocoach had just completed its initial test flight and was said by many to be the finest experimental model they had ever seen. True, the plane looks as if it were ready to make a regularly scheduled airline flight, so closely does it meet the standards of planes in daily transport work. Its size puts it in a class by itself, however, and it is expected to sell in the neighborhood of $9,000. The price of regular twin-engined planes ranges from $35,000 to $65,000, so it is easy to see that the plane should have an unchallenged position in the aircraft field.

One reason for the low cost of the ship is the fact that the engines used are 90 HP. Lamberts, which are made by a subsidiary of the parent organization and thus are available at a lower figure than would be otherwise possible. Either engine will keep the plane in the air. They follow the accepted practice and are mounted in outboard nacelles in the leading edges of the wing panels and are provided with full N.A.C.A. cowlings and Hamilton Standard metal propellers.

The streamline General tires and wheels are mounted on single shock-absorbing struts which retract in flight backward and upward into the rear of

XUM

the nacelles to present a minimum of drag from this source. Enough of the wheel protrudes to enable a safe landing, should the mechanism fail to operate, even in this retracted position.

The structure of the Twin is exactly the same as that of the Monosport and the plane is fabric covered. However, a fillet between wing and fuselage is something that is not found on the Monosport. All control surfaces have trimming tabs and landing flaps extending from the ailerons to the fuselage.

Entrance to the cabin, which seats a pilot and four passengers, is gained through a door and wingwalk which are located on the left side of the plane. In the nose of the plane is a large baggage compartment which is constructed of metal. Dual controls are provided and a full instrument board is installed. The windshields form a vee and ventilation is provided by sliding panels in the cabin. The tailwheel is a General streamline wheel and tire combination mounted on a single swivel strut.

Bunch recently took the Twin Monocoach on a long demonstration tour and during a week covered 1,868 miles in 12 hours and 35 minutes' flying time. During this trip and others of a similar nature, it was found that the plane has constantly and consistently been cruising at 130 MPH. with its full load of 5 people, 200 pounds of baggage, and 40 gallons of gasoline. The range with this load is 500 miles. As a 4-place ship the plane carries 70 gallons of gasoline, which increases its range to 900 miles. On a recent trip to Denver the plane flew against headwinds, fully loaded, on a single tank of 35 gallons; the distance covered was 480 miles. Total fuel consumption for both engines is only 10 gallons an hour.

Another new model in the Lambert line is the Monocoupe 110 Clipped-Wing Special, which bears some resemblance to the Howard "Mr. Mulligan" and is the fastest ATC Monocoupe. It is powered with a 145 HP. Warner Super-Scarab.

Specifications and performance figures on the Monoprep and Monosport G and the Twin Monocoach H follow. While these performance figures are the latest available, they may be changed slightly later, as the two new planes are still undergoing tests and soon will try to earn their Approved Type Certificates.

LAMBERT G. MONOPREP & MONOSPORT:

	Both Models
Overall Wing Span	29' 6"
Overall Length	18' 6"
Overall Height	7' 10"

	Monoprep G	Monosport G
Engine and Horsepower	90 HP. LAMBERT R-266	
Wing Area	145.73 sq. ft.	145.73 sq. ft.
Power Loading	15.5 lbs./hp.	17.2 lbs./hp.
Wing Loading	9.6 lbs./sq. ft.	10.6 lbs./sq. ft.
Empty Weight	760 lbs.	950 lbs.
Useful Load	595 lbs.	595 lbs.
Payload	380 lbs.	430 lbs.
Baggage	50 lbs.	50 lbs.
Gross Weight	1,355 lbs.	1,545 lbs.
Gasoline	25 gal.	25 gal.
Oil	2 gal.	2 gal.
Maximum Speed	120 mph.	130 mph.
Cruising Speed	105 mph.	115 mph.
Landing Speed	40 mph.	40 mph.
Rate of Climb	1,000 ft./min.	900 ft./min.
Service Ceiling	18,200 ft.	17,000 ft.
Range at Cruising Speed	590 mi.	590 mi.

(Concluded on page 62)

"Bunting" 1, Built by Curtiss-Wright Students

BUILT by students of the Curtiss-Wright Technical Institute of Aeronautics at Glendale, California, the "Bunting" 1 monoplane was test flown recently by Tex Rankin.

Powered by a two-cylinder Aeronca engine of 38 h.p., the little single-seater is probably the fastest airplane in its power class ever built. Although definite figures are not yet available, the top speed is claimed to be over 105 m.p.h. A few changes are to be made before the National Air Races in September, when it is hoped to exceed this figure.

The span is 26 ft. and the overall length 17 ft. 6 in.

The boys seem well satisfied and they should be with a job like this.

New Lockheed 12 Exceeds 250 M.P.H.

THE new eight-place Lockheed 12, recently completed at Burbank, California, promises to break all existing transport speed records by a wide margin.

According to sources believed to be authoritative, the all metal ship, powered by two 450 h.p. Pratt and Whitney Wasp Juniors, attained a speed of over 250 m.p.h. in the initial tests. Earlier estimates were placed conservatively at around 230 m.p.h.

Built primarily for executive and fast feeder line service, the new 12 follows the general design of the well known Electra, although it is smaller all around and has much cleaner lines.

The new Lockheed that proved to be a record breaker.

The NATIONAL AIR BOARD Says—

Unbiased Opinion to Further National Aeronautics

MEMBERS OF THE BOARD

Richard Aldworth
A. Raymond Brooks
Ray W. Brown
Douglas Campbell
Richard H. Depew, Jr.
William C. Fleming
Benjamin D. Foulois
Randolph D. Foulois
C. S. (Casey) Jones
C. T. Ludington
Betty Huyler Gillies
J. S. McDonnell, Jr.
Augustus Post
Dean C. Smith
Earl R. Southee
James B. Taylor, Jr.
D. W. Tomlinson
William Van Dusen
E. Burke Wilford
R. C. Wood (Paris)

Alexander Klemin, Chairman

AT THE third meeting (held at the Commodore Hotel, New York City, August 8th) the Air Board further strengthened its ranks by electing James B. Taylor, Jr.

Mr. Taylor is widely and popularly known in aviation, is a Naval Reserve pilot of vast experience, a skilled test pilot and a private plane owner who regularly flies his own ship. He will bring to the work of the Board a well informed and independent viewpoint which should be of great value.

"Dick" Depew and Casey Jones attended a meeting for the first time, stimulated and enlivened discussion with racy wit and independent views, which brought the flying field right into the Board room.

PARACHUTES AND PATERNALISM

A memorandum of the Bureau of Air Commerce elicited much discussion:

Provision for Parachutes

Many of the smaller type aircraft have become very popular for flight instruction and for demonstration of flying ability in connection with tests for pilots' licenses.

Such usage requires a certain amount of mild acrobatic maneuvers and spins, during the performance of which both the instructor and student are required by regulation to wear parachutes.

In the furtherance of his efforts toward minimum dimensions and structural weight the manufacturer of small aircraft might not realize the importance to his owners of adequate provisions for parachutes, in the form of ample head room, seat width, clearance for controls and weight allowance.

The situation is, however, so actually important at present that some action is necessary in the case of those models which are inadequate in this respect.

We urgently recommend therefore that all manufacturers review their present models with the object of improving them in this respect if necessary.

This Bureau will undertake to work out a procedure which will permit present owners to take pilots' tests in their airplanes but no permanently satisfactory solution can be reached unless all manufacturers will cooperate fully on new aircraft.

We believe that you will find an owner satisfaction value which will adequately compensate for the expense of production changes.

It is perfectly true that a parachute is a flyer's best friend at times, and that members of the Caterpillar Club remain eternally grateful to their chutes. Nor does anyone dispute that in taking an acrobatic test, however mild, a parachute is essential. But the owners of private planes do not always take their license tests in their own planes, and for many of them acrobatic flying of any description is strictly taboo.

The Department is perfectly right in bringing the matter to manufacturer's attention in a memorandum. But, said the assembled members, this is an age of super-regulation. What begins in a Bureau with a mild suggestion is apt to be followed by a rigid regulation. Is paternalism in aviation really desirable?

Here is a worthwhile suggestion; let the response from aviation circles be even mildly favorable, and the next step will be an amendment to the regulations which will throw many excellent planes into the discard, increase the cost and decrease the efficiency of others and generally put a hindrance in the way of private flying.

Why not let nature take its course? When owners find they cannot take license tests in their small planes because these ships cannot accommodate parachutes, sales resistance to such planes will be set up. Wise manufacturers will meet the situation by making provision for parachutes, with designers using all their skill to this end.

But why be violent in forcing the change? Prohibition did not stop drinking, but made gangsters flourish. Why force all planes to be changed to carry chutes, when some at least will be flown without ever having a chute on board? Why crack down on manufacturers? Regulations start with a small pamphlet and end up with a big cumbersome book.

A definite resolution was arrived at:

"Resolved that the Bureau of Air Commerce is well advised in bringing to the attention of manufacturers of small planes the advantages of provision for parachutes, but that no mandatory amendments to regulations should be adopted in this regard."

There was no dissenting opinion.

WORTHLESS INVENTIONS

The English magazine Punch gave the

The Vickers "Vimy" bomber, equipped with Rolls-Royce Eagle engines, Mk. VIII. It was on this type of ship that Browne and Alcock made their early transatlantic flight.

following advice to those about to get married: "Don't." Perhaps the same advice should be frequently given to those taking out patents, particularly aeronautical patents.

Randolph F. Hall, a noted engineer, inventor of the successful Hall automatic flap, put the case very well in a written communication to the Board:

> **Examination of patents issuing each week show that in the aeronautical as in many fields, the greater majority of patented inventions are of the unsound impractical variety.**
>
> **Such inventions, while no doubt born of enthusiasm, aside from the patent disclosure, rarely get any further than the mind of the inventor and indicate that real knowledge of aircraft science and the art to have been completely lacking.**
>
> **While the field may not be old, and admitting that sometimes good ideas are stumbled into, because of the extravagant waste of time and money expended on worthless inventions, caution is suggested to inventors contemplating a patent who are not familiar with the patent business.**
>
> **If possible, the advice should be sought from some disinterested party who knows about patents. It would be well to remember that all patent lawyers are not scrupulous. Many are more concerned with the inventor's money than honestly advising on the merit of the invention or on the chance of securing patent protection.**
>
> **A search into the prior art before proceeding with the patent application is often desirable. The possibility of return from the invention should be also considered.**

E. Burke Wilford took a somewhat contrary view. True that most inventions are impractical, but invention is the very breath of progress, and if but one invention out of a hundred succeeds, the inventive effort has been fully justified. The wise attitude in dealing with inventors is not just to disregard them, but to recommend search and review of the art, a beginning where others have left off. Mr. Wilford made this very true observation also, that inventions may appear at first breath wildly impractical and yet contain some measure of possibiliies. A sympathetic view and an attempt to winnow the wheat from the chaff are in order.

The Chairman introduced a personal story, which he has repeated so many times that his friends are positively afraid of it. When twenty-five years old or thereabouts and an instructor in aeronautics at the Massachusetts Institute of Technology (therefore on both grounds, omniscient), he was consulted by a gentleman who suggested the internally braced wing, and a patent thereon—well ahead of Junkers and all others working on this topic.

In his best professional manner he gave a lecture on the impossibility of internal braced wings. They would be too thick and therefore have too much drag. For strength, a truss had to have depth and so either a biplane or an externally braced monoplane were alone possible. AND so on and so on. The visitor was convinced and thanked the professorial young man profusely.

"You have saved me much trouble and expense and I am infinitely obliged to you." If the patent covering internally braced construction had been taken out in 1915, it might have been worth millions. Dr. Klemin has never seen this gentleman since and has since grown much more cautious in discarding inventions.

THE CIRCUMLOCUTION OFFICE OR THE RUN-ROUND

Modern youth rarely reads Charles Dickens, at least only in prescribed

(*Concluded on page* 54)

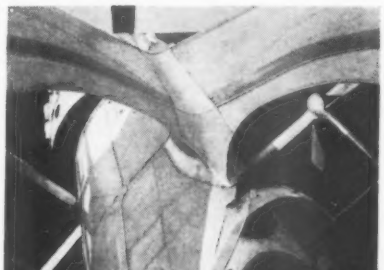
The Loire-Nieuport Pursuit Plane

A head-on view of the Loire-Nieuport pursuit plane. The machine-guns are in the leading edge of the wings.

THE Loire-Nieuport pursuit ship is a single-place gull-wing monoplane powered with a Gnome-Le Rhone 1,000 h. p. engine.

The high wing position gives the best possible visibility for the pilot, and with two machine-guns mounted in the leading edge of the wings, it is a vicious adversary. Again, the height of the pilot's seat is adjustable so that he can get a good view of the sky or the combat.

The monocoupe fuselage has a vertical panel on each side for the improvement of the pilot's view downwards and, together with the form of the wing attachment, the best possible visibility is had.



A close-up of the gull-wing to body connection.

The gull wings of the Loire-Nieuport pursuit plane.

A Few French Aviation Notes

Possibly, the fact that every Frenchman, whether a count or peasant, may have an opportunity to spend a portion of his required military service in the air corps, and thus get advanced flying instruction at government expense, may have some bearing on the lack of such requirements for holding a civil license.

Also due credit must be given to such fine organizations as the Morane and Caudron-Renault flying schools. Their students are given the most thorough training in all phases of aviation, as they are going into the industry from a professional and commercial point of view.

We are not attempting to prove that the French system is best, nor that it is the answer to our own problems. However, when we remember the reams of protests we have read, the resolutions and committee reports that have been made regarding the possibility of freeing the private flyer from some of the strict regulations that must necessarily be placed on commercial organizations, then we think the French system is an interesting example and might well be used as a basis for comparison.

The Aero-Club de France, from whom we secured the above information, is an interesting organization. It was founded in 1889 to encourage the development of all forms of aeronautics: scientific, commercial, industrial, military and sport fly-

(*Concluded on page* 54)

The Lear Aircraft Radio

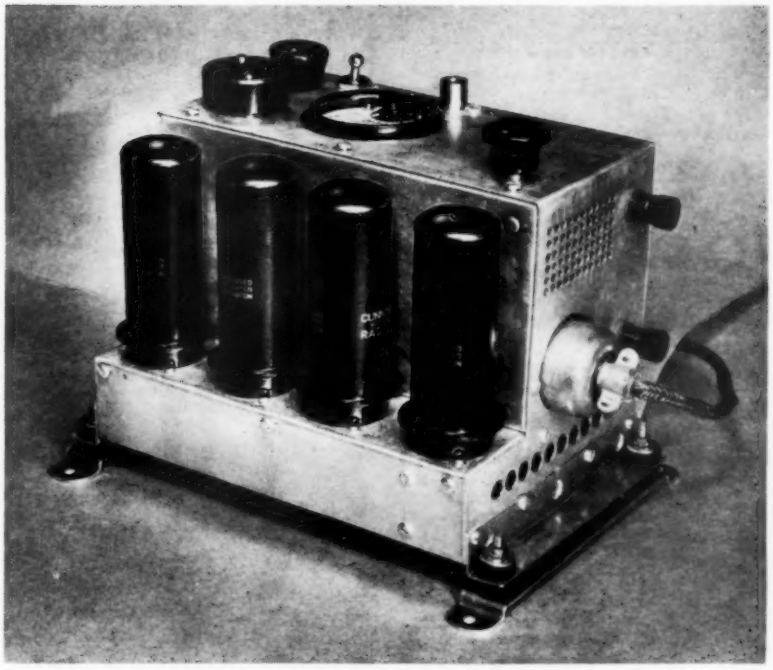
A NEW highly workable two-way aircraft radio system is currently announced by Lear Developments, Inc., New York City.

Complete with transmitter and receiver the set weighs only 23 pounds, and the two units measure 5x7¾x5½" deep and 5x7¾x4½" respectively. And the system was developed in the company's "flying laboratory," actually in the air, with the idea in mind to supply a light, compact, highly workable radio set to fit the purse of our swiftly growing list of private flyers. It sells for well below $500.

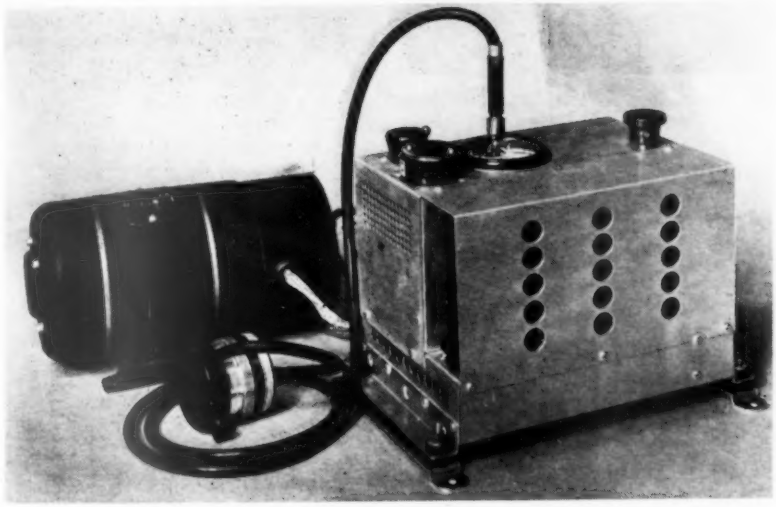
Whereas the units are extremely compact, to the point of being rather tiny, they are not to be placed in the "Midget" class. It took considerable ingenuity and many flight tests to develop a design that would save space without making a sacrifice of the power and quality of the system. Likewise, long hours of effort were necessary in order to incorporate bulldog ruggedness to meet and withstand the vibration and rough landings encountered in aircraft operations.

If you are technically-minded, here's what goes on inside the Lear-O-Phone: It has an output of 15 full watts, 100% modulated. The frequency range is 2,900 to 7,000 kilocycles, using proper quartz crystal. The receiver features 3-bands, 220-400 kc, 550-1500 kc and 2800-6300 kc. Low battery drain permits economical operation from either storage batteries or dry cells, while an automatic static limiter reduces static bursts to a low minimum.

Flyers everywhere, as well as distributors, hail the arrival of this long-awaited and rapidly-growing necessity with an enthusiasm that approximates unalloyed joy, for the present-day pilot feels an urgent need for the latest safety equipment just as sharply as does his airline brother. And beyond the fact that he feels that radio equipment is the modern thing to have, he also finds it a very necessary implement to have flying around a busy airport.



The exceedingly compact Lear Midget aircraft unit.



In center: Aircraft receiver panel. Below: Showing the compact form of generator employed.

Three years ago, POPULAR AVIATION published an extended account of the experimental work being conducted by Mr. Lear at the Curtiss-Reynolds Airport, Chicago, work that eventually led to the perfection of the present model. And, of great interest to radio engineers was the work on ultra-short waves (or should it be infra short waves?) being carried on at this time.

In other words, the Lear radio has had thorough and searching development and has seen extended practical service, and this means a lot in aircraft radio equipment. Aircraft radio is a thing apart from the common garden variety of household radio and, as a rule, a radio receiver does not lend itself kindly to the environment of an airplane.

First is the battle with weight, which has been well won in the Lear equipment and second is the matter of current supply which is always a difficult problem where batteries must be depended upon and not very large batteries at that. The problem of low battery drain is as tough as any of the numerous nuts that must be cracked but in the Lear, the current consumption has been reduced to a minimum.

Still another enemy of aircraft radio has been baffled in the Lear equipment and that is the stunning effect of full strength static bursts.

XUM

An Immersion Type Oil Heater

by DAN HENRY

THE past winter gave all of us plenty of trouble and, because of the long continued intense cold, we were brought face to face with an exceedingly difficult warming-up problem.

Many lightplane owners had no special heating devices and they, of course, sometimes found it impossible to take-off because of the low oil temperature. The larger ships, in the Army and on the scheduled airlines, were much more fortunate for they had efficient means of heating the oil.

All this upheaval among the private pilots led to the development of the immersion oil heater that is the subject of this story. I address this particularly to the lightplane enthusiast for the heater eliminates all the former muss, fuss and worry encountered in cold weather and is comparatively cheap to build.

The heater makes it possible to be in the air fifteen minutes after the thought of flying enters your head and is no more an inconvenience than the ordinary summer requirements. With the tough lesson of last winter behind him, every pilot will appreciate the advisability of having one of these heaters ready for service before the leaves start falling.

Fig. 1 shows a commercial immersion type oil heater unit which is designed so as to present a maximum of heating surface with minimum external dimensions. It can be installed in the smallest motors and can be purchased, according to size, for $2.00 to $4.00. I prefer the 600 watt size because of its rapid heating but the smaller size can also be employed. This particular heater unit is made by The Edwin L. Wiegand Co., Pittsburgh, Pa., but it is likely that similar heaters of other makes can be found if the search continues long enough—in my case, several years.

In my particular case, the heater was installed in an Aeronca engine where the only work necessary is to drill a hole in the sump case cover plate to accomodate the heater. This can be done at the time of the regular oil change so that the time required will be negligible. The various figures show the method of installation in the Aeronca, but the process will be but little different in other ships.

Electrical connections to the heating coil are run to a plug on the cowling or dash where a lead may be connected from any convenient source of current, a lamp socket, etc. The coil is designed for 110 volts, either A.C. or D.C., and will perform indefinitely. The only necessary operation is to plug the connection into the circuit and the heating begins immediately.

This has been used in connection with aerial news photography where there must be no delay in getting off, regardless of the weather or outdoor temperature.

I feel that everyone owes it to himself to make this simple change for winter flying.

PIX OF THE HEATER INSTALLED ON AN AERONCA

Fig. 1. This is the commercial heating element installed in the engine for heating the oil.

Fig. 2. Wire and wire end employed for connecting electric current with heater.

Fig. 3. The heating coil installation completed and wiring connected ready for service.

Fig. 4. Showing the heater flange and heater removed for inspection or cleaning.

Solidified Gasoline

By ROBERT W. A. BREWER

WHILE the use of fuels normally solid such as naphthaline, for the purpose of driving cars, has been known for many years it was not until about 1910 that gasoline in a so-called solidified state made its appearance in Europe.

In the first place, the liquid is not changed to solid, but is merely held in what a chemist calls a "soap." The apparent effect is that of a jelly consisting of fine cells in which the liquid is imprisoned.

The first well known process, which is probably symbolic of others, is stated in the patent of Valerin Rosculetz of Issay, Roumania,, which was brought to England by Constantinescu the inventor of the gun synchronizer and the torque converter which bear his name. The Rosculetz patent briefly states that the object is to provide a simple process of solidifying hydrocarbon liquids.

A neutral fat with high melting point, preferably stearin, is heated at 100 to 120 degrees C. with an equal quantity of hydrochloric acid. The mixture is then cooled, whereby the stearin is soluble at normal temperatures in liquid hydrocarbons in the proportion of 0.5 percent. to 5 percent.

The solution is heated in a closed vessel to between 70 deg. and 100 deg. C., according to the nature of the fuel, and at this temperature an equally hot saturated solution of sodium hydrate in pure alcohol is added to the first solution the proportion of the second being double (1% to 10%) that of the first. The mixture momentarily froths and on cooling uniformly solidifies (gelatinizes) and is ready for use.

To collect the stearic acid it is necessary to squeeze the substance so that part of the active solidifying agent can be used again. Conversely, the fuel is obtained by slight pressure upon the jelly and heat is added.

Fuel in this state has the advantage that fire, once started, does not spread and a piece of the burning fuel can be held in the hand. There is an illustration of this in Automotive Industries, November 22, 1930. Demonstrations were made stressing the ease with which fire could be put out by simply wiping the surface of the burning lump of fuel with blotting paper or by blowing. This made an attractive fuel for lamps and it was considered for the manufacture of candles also.

The question of handling was heavily stressed because of the restrictions at the time prevailing. Fuel had to be brought in ships from abroad and had only a single way freight in consequence. Other commercial considerations in rail handling showed some merit in favor of this new form.

The matter of handling cuts both ways because the advantage of the solidified form is not maintained for bulk purposes

(*Concluded on page* 65)

Canadian Air Ventures

FOR those who would become commercial pilots in out-of-way places, the ability to fly is not enough. True, it is a great part of the training but often resourcefulness, ingenuity and adaptability to existing circumstances mean much more than the accomplishment of guiding a ship into its element. A glance at the official records of Canadian Airways, Ltd., shows us the following:

On December the 20th, 1933, Pilot Bibby flying a Fairchild 71C left Moosonee for Povungnituk, 600 miles north on the Ungava Coast of the Hudson's Bay. Although the why and how doesn't matter, an undercarriage fitting broke on landing at Povungnituk and disabled the plane.

Now we come to the resourcefulness of pilots and operators of the Canadian Airways. When Bibby's plane did not return on schedule the base at Moosonee knew something was wrong. Planes scarcely ever fail to turn up on time so another ship, flown by Pilot Lymburner, was sent out over the hazardous route. Thus, we find that opportunity is never neglected by these men.

Lymburner found Bibby at Povungnituk and he also found the disabled plane jacked up in a newly constructed snow shelter. Its wings were folded back and curious husky dogs crowded around wondering what it was all about. Thus, was a "farthest north" repair shop constructed.

Lymburner immediately loaded the waiting passengers and flew them to their destination, 100 miles further north, and returned to Port Harrison. Ascertaining what repairs were required he took off again and after picking up a welder and his equipment returned to Bibby's stranded plane. The welder and air mechanics effected repairs at once and the two planes hopped off once more. Flying southward they stopped at all fur trading posts along the route and returned to Moosonee with a valuable cargo of furs.

The famous "Punch" Dickins of Greenly Island fame was flying a Fokker Super and while landing on the rough water at Deerpass Bay, a violent gust of wind plunged one of the floats rather deep. The stay snapped and the strut crumpled completely crippling the ship.

Serious as this mishap might be to others, "Punch" merely grinned and unlimbered his axe. Chopping spruce trees down and trimming them carefully he fashioned struts and stays which he lashed to the fractured parts by rope. Not a very secure job but sufficiently strong to enable the intrepid pilot to bring his ship out to Fort Smith. Incidentally this was the first crossing of Great Bear Lake by air in 1929.

Their boat blown up by an undetermined explosion, five men lay in a lonely bivouac on the bleak eastern shores of Great Bear Lake. They had little or no supplies and out there the cold waters of the lake clutched two of their comrades in its unyielding grip.

As they huddled there in helplessness two of them, more hardy than the others, set out on foot for the air base at Cameron Bay more than 100 miles away. They were making the only move possible to aid their comrades.

After six days of untold tortures the two men arrived at Cameron Bay where they poured their stories into the sympathetic ears of the airmen. A few minutes later and two planes carrying Doctor T. O. Byrne and medical supplies roared off to the north. Again northern resourcefulness and ingenuity came to the fore to save the lives of these marooned men. Within two hours they were in warm hospital beds and assured of a speedy recovery.

Strange as It May Seem

by JOHN HIX

UNITED'S COAST-TO-COAST PASSENGERS CHANGE THEIR WATCHES 3 TIMES IN 10 HOURS TO CONFORM TO TIME-ZONES....
CARSON SINK- Nevada -
ON UNITED'S COAST-TO-COAST ROUTE WAS SO-NAMED BECAUSE WATER EVAPORATES SO FAST THERE... PROSPECTORS THOUGHT IT SANK INTO THE GROUND....
AN AIRPLANE CAN FLY LOWER THAN ANY SUBMARINE EVER DIVED!

Courtesy United Air Lines

Swedish Air Transport Progress

THE Swedish Air Transport Society reports for the past year, the twelfth year of its activity, a growth in the number of passengers from 18,072 in 1934 to 22,956 in 1935, an increase of more than 27 percent. The amount of air mail flown last year also increased by more than 27 percent. Planes of the Air Transport in 1935 flew a total distance of 1,000,000 kilometers.

The director-in-chief of the Society, Captain Carl Florman, reports that during the past twelve years of uninterrupted flying, not a single passenger carried by planes of the Air Transport has been killed or seriously injured.

Model Meet at Gotch Airport

AN interesting gas model meet, known as the "Midget Air Races," was held at Gotch Airport, Los Angeles, Calif., under the supervision of G. H. Gotch, the managing director.

The attendance of over 10,000 spectators indicates the great interest that the public has in gas model flying. There were 131 contestants in all, which is a great number of gas model owners in any town. The precision contests lasted two hours and everyone was delighted with the affair. The following list of averages shows a high type of performance.

AVERAGE PERFORMANCE

Take-off time	4 seconds
Take-off distance	40 feet
Motor running time	18 to 33 seconds
Altitude in specified time	105 feet
Spot landing	Within 400 feet of center
Take-off attitude	80.89% perfect
Flight attitude	75.70% perfect
Landing attitude	57.60% perfect
Workmanship, design, etc.	58.00% perfect

The first seven winners will be found in the following list with their scoring, age, etc. It should be noted that 180 points rating is a perfect score.

SHIP NO.	SCORE POINTS	PLACE (ORDER)	OWNER'S AGE	NAME (CONTESTANT)	NAME OF ENGINE USED IN CONTEST
14	159	1	12	David Fletcher	Brown Jr.
60	153	2	36	V. V. Hiatt	Gwin Aero
59	151	3	20	Howard Broughten	Brown Jr.
85	150	4	21	I. J. Hassad	Brown Jr.
62	148	5	15	Bob Hollingsworth	Gwin Aero
47	147	6	28	Ray Smith	Gwin Aero
23	145	7	17	Jim Stevenson	Baby Cyclone

The Gwin Aero motors and the Baby Cyclones are 1/6-horsepower while the Brown Juniors are 1/5 horsepower, a considerable difference in a contest of this sort.

The N. A. A. Kit Booklet

THE Contest Board of the National Aeronautic Association, Dupont Circle, Washington, D.C., has prepared and issued a descriptive bulletin on "kits" for the information of those who are organizing competitions for the sportsman pilot.

This booklet is a highly interesting publication for clubs organizing competitions such as treasure hunts and events of that type. The kits described consist of all necessary competition equipment such as folders, entry blanks, instruction sheets for competing pilots, suggested press releases, general procedure instructions and all material necessary for publicizing and conducting air-meets.

Even badges for the officials and clipboards for the judges are included. Any club interested in holding competitions or meets should send for the bulletin.

Smiles

Cadet (rushing into office): Say, Smith just made a one point landing!

Instructor: What? Where is he?

Cadet: Stuck on a church steeple.

* * *

The parachute jumper's theme song: "It Don't Mean A Thing If You Don't Pull That String."

Britain's Formidable Fairey Battleplane

The giant Fairey battleplane in full flight, a plane of remarkably clean appearance.

ONCE married to the biplane arrangement, Great Britain is now in the throes of the low-wing monoplane fever as with other nations. Instead of the military planes leading the way, as frequently remarked, it rather seems as if the military authorities were following commercial airline practice.

And now we have the British "Fairey Battle", a light two seated bomber that bears the unmistakable impress of a deluxe airliner. It is the familiar clean looking low-wing ship with retractable landing gear, cantilever wings and all the rest of the appliances found on a scheduled airliner commercial job.

One of the outstanding features that is immediately apparent is the great aspect ratio or the narrow tapered wings. The use of a liquid cooled-engine, instead of the conventional American radial, further cleans up the ship by very greatly reducing the presented area. The fuselage is a novelty, inasmuch as it is constructed of long aluminum alloy strips, welded together.

While no information has yet been given as to its performance, yet it is said to be at least 50 m.p.h. faster than the fastest French bombers which would bring the speed up to approximately 300 m.p.h. In spite of its high speed, it is very maneuverable and the battle is reported to have carried out perfect loops, rolls, half rolls, figure-eights, etc., with all the ease of a single-seater.

Trailing flaps for assistance in landing, an automatic pilot and all the other airline accessories are included in the equipment.

The Way They Graduate Students in Japan

JAPANESE young men and women are rapidly developingg acute cases of air-mindedness and it will not be long before the Land of the Cherry Blossoms will witness great numbers of its youth in flying attire.

Thus, the festive scene that we witness below is none other than a banquet tendered to some students upon the completion of their training course and it is interesting to note the great percentage of young girls included in this group. This might prove an inspiration to American schools in making their institutions more popular by serving lunch at the hangars with champagne or whatever they may be drinking in the picture.

Here they are, clustered about the festive board on graduation day.

Centrifugal Propulsion

by BRONSON W. ARMITAGE

An extremely interesting and instructive account of the experiments made by the author with "jet" type or "reactor" propulsion. Mr. Armitage is to be congratulated on his pioneering work.

THE only similarity between the centrifugal propeller and the conventional screw propeller is the fact that the forward thrust of each type results from the reaction of the air being thrown backward.

The two types of propellers are entirely different in the manner in which the forward thrust is applied to the nacelle or fuselage. In the case of the screw propeller, the thrust force is applied first to the propeller blades, then to the nacelle by way of the engine frame, but the centrifugal propeller and nacelle combine to throw the air backward in such a manner that the forward thrust force is applied *directly to the nacelle.*

The application of the forward thrust to the blades of the screw propeller results from the fact that the rotation of the propeller through the air creates a higher pressure on back of the *blades* than on front, but the application of the thrust force to the nacelle of the centrifugal propeller results from the fact that the rotation of the propeller creates a higher pressure on the rear of the combination of hub and nacelle than on front.

The advantages of the centrifugal propeller result from the fact that it has a smaller diameter than the nacelle or fuselage used with it and has a diameter much less than that of the screw propeller of conventional design.

Assuming the propulsive efficiency of the centrifugal propeller, as finally developed, to be equal to that of the screw type, the smaller diameter of the centrifugal would result in the following main advantages:

1—Use of a higher speed, direct drive engine of less weight.

2—Less propeller-air noise.

3—Less propeller danger to persons around airplane on ground.

4—A smaller rigid landing gear of less weight and resistance.

5—A smaller, simpler, lighter retractable landing gear.

In other words, the use of the centrifugal propeller would make possible the design of an airplane having greater overall efficiency, from an economic as well as an aerodynamic view point.

The direction and speed of travel of a particle of air along the surface of the propeller hub is determined by the following four factors:—the shape of the hub and nacelle, the static air pressure, the force exerted on the particle by the propeller blade, and the inertia of the particle.

The combination of the inertia of the particle and the force exerted on it by the propeller blade results in a centrifugal force that moves the particle away from the axis of rotation of the propeller; at the same time, the static pressure prevents the particle from leaving the surface of the hub, and the resulting path is rearward along the surface of the hub and nacelle. (The fluid properties of air cause successive outer layers of particles to conform to the path taken up by the layer adjacent to the surface of the hub and nacelle, and the resulting picture of the airflow from the propeller toward the rear of the nacelle is approximately that of a cylindrical column of air having an axis that coincides with that of the propeller and nacelle.

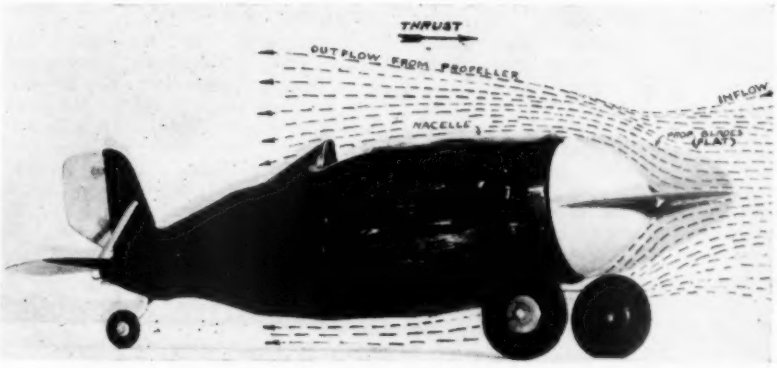
Since the propeller blades are thin flat surfaces lying in planes containing the axis of propeller and nacelle, and resultant air forces must be normal to these planes and the line of flight, the thrust force, which is parallel to the axis, cannot be received by the blades. If the blades do not receive the thrust force, it must be received directly by the propeller hub and nacelle; therefore, the static air pressure on the leading portion of the combination of hub and nacelle must be lower than that on the rear portion.

The forward thrust force is the reaction force of the air due to its change of momentum by the propeller blades, but the actual application of this force to the nacelle must result from the aforestated difference in static air pressure on the front and rear portions of the combination of hub and nacelle. The propeller blades do not *pull* the nacelle; it is *pushed* forward, because the air pressure behind it is greater than that in front.

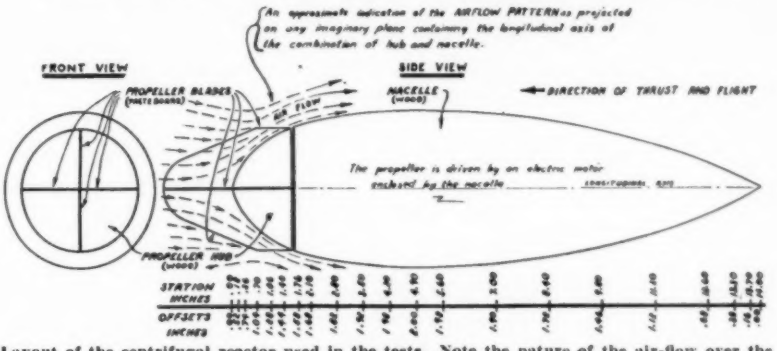
Preliminary experiments having shown that an airflow approximately parallel to the axis of rotation of propeller could be obtained from a centrifugal type propeller consisting of a hemispherical hub supporting several flat blades having surfaces parallel to the propeller axis and joining there, the next step was that of finding the best plan-shape for these blades.

The streamline shape for the combination of hub and nacelle was more or less arbitrarily chosen to be that of the Navy Strut No. 1. This shape was retained during all of the static and dynamic tests, although the fact was realized that a better shape probably could be obtained from more extensive experiments.

A large variety of plan-shapes for the



A model of the repulsion centrifugal type plane designed and built by Mr. Armitage.


An approximate indication of the AIRFLOW PATTERN as projected on any imaginary plane containing the longitudinal axis of the combination of hub and nacelle.
FRONT VIEW
SIDE VIEW
PROPELLER BLADES (WATERBOARD)
AIR FLOW
NACELLE (WOOD)
DIRECTION OF THRUST AND FLIGHT
The propeller is driven by an electric motor enclosed by the nacelle
PROPELLER HUB (WOOD)
STATION INCHES
OFFSETS INCHES

Layout of the centrifugal reactor used in the tests. Note the nature of the air-flow over the nose of the fuselage.

XUM

flat blades were tested, until the one that gave the largest ratio of static thrust to absorbed power was found. In the first series of blades tested, the perpendicular distance from the surface of the hub to the leading edge of the blade was constant from the blade tip to the axis; however, the best type of blade shape was found to be one in which this distance increased from the tip to axis.

An eighteen inch wind tunnel was designed for the dynamic tests of the model propeller but the lack of finances necessitated the use of a substitute system, whereby the model was suspended by wires in such a manner that it was free to travel under its own power in a circular path having a diameter as large as about ten feet. The diameter of this path was a function of the linear velocity of the model.

Conditions not permitting the use of a variable speed electric motor for driving the propeller, the linear velocity of the model was made a function of the air resistance of the complete system and this resistance was controlled by the varying of the area of the circular disc attached to one of the suspension wires.

The thrust power of the model was determined from its linear velocity and the total calculated air resistance of the model, resistance disc, counter weight sphere and the suspension wires. The input power was determined from the propeller torque and r.p.m. data from static tests and assumed to be same for dynamic tests.

The results indicated a propulsive efficiency of only about twenty percent for this particular model (3 inch diameter), but there is good reason to believe that additional experiments with a much larger model would show better results and point the way to necessary improvements.

Experiments and deductions have shown that the blades of the centrifugal propeller impart motion to the air; that the combined shape of the propeller hub and nacelle controls this motion so that the airflow has a rearward direction; and finally, that this controlling of the airflow creates a lower air pressure on the forward surface of the combination of hub and nacelle than on the rearward surface, resulting in a forward thrust on the nacelle.

Therefore, the fact is obvious that the centrifugal propeller cannot simply be exchanged with a conventional screw propeller on a conventional fuselage or nacelle. The advantages of the centrifugal propeller can be obtained only by an airplane designed to use it in conjunction with a properly shaped nacelle completely enclosing a high-speed, direct-drive engine.

Theory and practical experience have shown that, for a given forward thrust power, the propulsive efficiency of the conventional screw propeller increases as the diameter is increased. In view of this fact, the smaller diameter centrifugal propeller might seem at first thought to be in an unfavorable position as to the possibility of it being developed to have as high propulsive efficiency as the screw type.

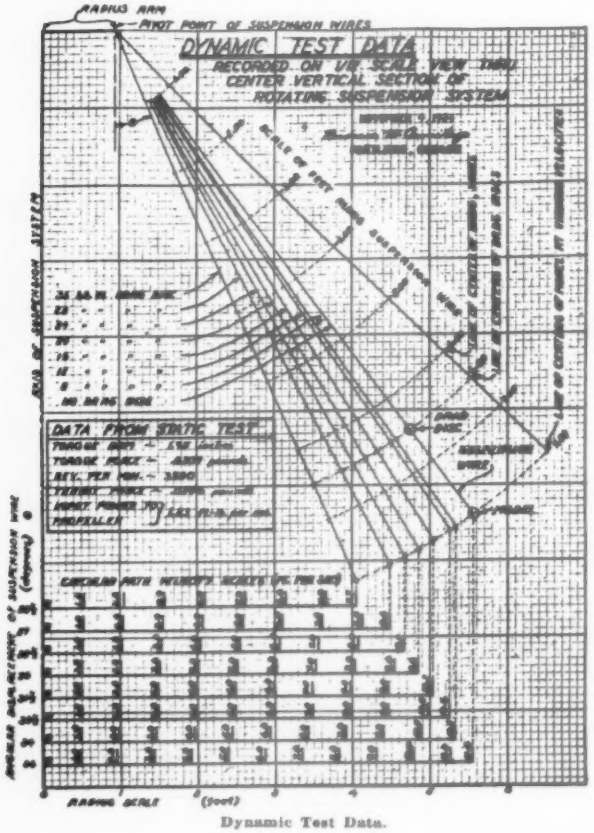
However, in the consideration of this subject there is an important unknown factor that prevents, or should prevent at least, the offhand condemnation of the centrifugal propeller merely because of its smaller diameter.

This unknown factor is the mass of air that is thrown backward per unit time by the centrifugal propeller. The mass thrown backward by the screw propeller is determined largely from the diameter of the column of air leaving the propeller, and this diameter is approximately as large as the propeller diameter.

The case of the centrifugal propeller is quite a bit different, and this writer is not aware of the existence of any definite experimental evidence showing the relation between the diameter of this propeller and the mass of air it throws backward per unit time.

After taking into consideration this unknown factor, the very interesting performances of small working models and the possibility of much better results from larger models, this writer reaches the conclusion that additional experiments are desirable and justified.

END.


RADIUS ARM
PIVOT POINT OF SUSPENSION WIRES
DYNAMIC TEST DATA
RECORDED ON VIZ SCALE VIEW THRU CENTER VERTICAL SECTION OF ROTATING SUSPENSION SYSTEM
DATA FROM STATIC TEST
RADIUS SCALE
(Feet)

Dynamic Test Data.

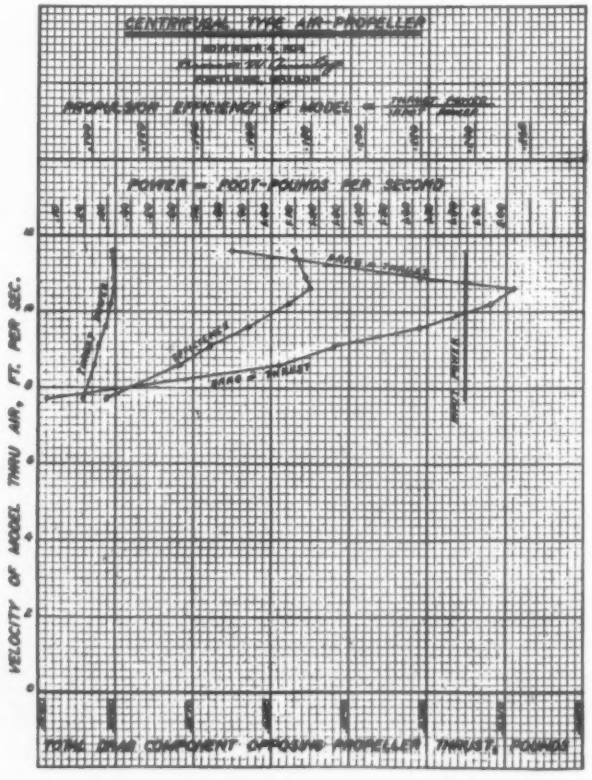
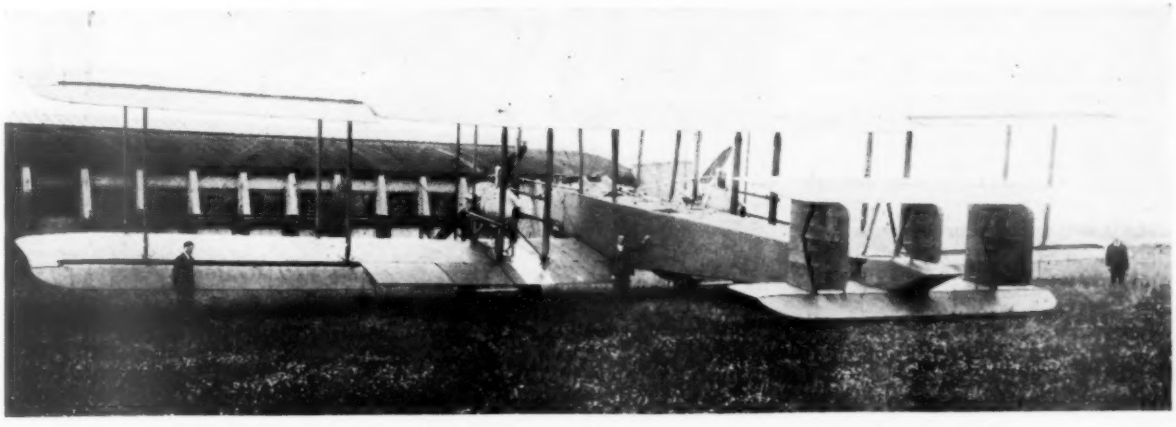

CENTRIFUGAL TYPE AIR-PROPELLER
PROPULSIVE EFFICIENCY OF MODEL =
POWER = FOOT-POUNDS PER SECOND
VELOCITY OF MODEL THRU AIR, FT. PER SEC.
TOTAL DRAG COMPONENT OPPOSING PROPELLER THRUST, POUNDS

Chart showing propulsion efficiency, power and drag component of centrifugal system.

Gossip Along the Airways

A feature dealing with the scheduled airlines, their equipment and personnel. Bits of interest to the industry in general.

by M. A. RODDY



Vickers "Virginia", a large British bomber type of biplane. A rear view showing the triple rudders.

POPULAR AVIATION is inaugurating with the current issue this new department which will feature airline news and activities as well as personal notes of the airline pilots.

It is the intention of the publisher and editors of POPULAR AVIATION that the publication shall be the medium by which the air traveler and all associated with the industry shall keep posted. Suggestions and letters from readers are welcomed by this department.

INTERNATIONAL AIR RECORD

When United Air Lines completed its 100 millionth mile of flying for over 10 years' operation it became the first airline in the world to reach that coveted mark which represents 23,000 days and nights or sixty-three solid years of flying at an average speed of 180 miles per hour.

According to President W. A. Patterson the establishment of the international record was featured by several outstanding developments which included the first coast-to-coast air service, the first long distance night flying of passengers and cargo on regular schedules, the first multimotored transport planes capable of a speed over three miles a minute, the first two way radio telephone communication between planes and the ground, the first controllable pitch and constant speed propellers and the first instrument-radio landing system.

During the ten year period of operation United has reduced the original flying time of its coast-to-coast run from thirty-two hours to the present schedule of sixteen hours and is now flying over 1,500,000 miles monthly. . . . nearly one-third of the 100,000,000 miles was flown within the last two years. . . . CONGRATULATIONS!

OCEAN FLYING

PAN American Airways has completed 13 round trips over the 8,100 mile trans-Pacific system, totaling for the three big flying boats and forty crew members more than 210,000 miles of flight over the ocean.

Many problems were faced and overcome by PAA in its pioneering. After the first two flights motor troubles developed, which were corrected, but ultimately Captain Edwin C. Musick had a motor failure when 700 miles at sea, necessitating immediate return to the mainland for a complete overhaul of all motors.

According to Col. Clarence Young, operations manager of the Pacific division, mail poundage dwindled because business men were uncertain as to the dates when letters would be carried. Post Office Department figures average 147 pounds for the westbound flight on

The Vickers "Virginia", a large British biplane bomber showing the twin engine mountings and the independent engine section landing gear.

the San Francisco-Manila run and about 285 pounds on the eastbound trip, costing the government approximately $29,296.67 for each return flight. Under the contract award PAA will not have to begin bi-weekly service until next November.

Announcement has been made by J. T. Trippe, president, that continued improvement has been noted in Pan American Airways corporation earnings. Net income totaled $1,193,732 for 1935 as compared with $1,064,471 for 1934.

Route mileage of the system and associated companies totaled 40,479 miles, an increase of 9,220 miles for the year, while the number of terminal and intermediate airports increased from 166 to 202 and ground radio control and communication stations increased to 122 from 95 during the year.

$4,000,000 was expended for freight equipment and ground facilities, while $700,000 in equipment and facilities were retired.

AMERICAN AIRLINES NOTES

E. L. CORD has returned from Europe to again head the Cord corporation, a post he relinquished in 1934, and L. B. Manning, his first lieutenant, will assume the duties of chairman of Aviation corporation, of which he is also president.

The Reconstruction Finance Corporation has granted a loan of $1,236,000 to American Airlines, Inc., which will be secured by equipment trust certificates similar to those used in the purchase of railway equipment and will mark the first such financing in the history of aviation.

Naval officers and civil aviation dignitaries officiated at the christening of American Airlines "Flagship Illinois" on its maiden non-stop Chicago-New York schedule. Captain Edward A. Evers, commandant of the Fourth Naval District, together with sixteen officers of the U. S. Naval Reserve Corps, formed the naval guard of honor, while on the civilian side were Merrill G. Meigs, publisher of the Chicago American, and chairman of the Chicago Aeronautical Commission; Elwood B. Cole, secretary of the Illinois Aeronautical Commission; Walter Wright, Municipal superintendent of airports; John Casey, manager of Municipal Airport; George Vest, Department of Commerce; C. R. Smith, president, and Ralph S. Damon and T. J. Dunnion, vice-presidents of American Airlines.

Mrs. Lincoln Harris christened the huge Douglas which initiated less than four hour non-stop service between Chicago and New York and was piloted by Walter H. Braznell, senior pilot of the line's eastern division, with William Miller as second pilot.

Fifteen second pilots have been promoted to first pilot position by AA, which has also installed the longest teletypewriter system in the work, a 900-mile line linking Chicago, Detroit, Buffalo, New York and Boston.

(*Concluded on page 68*)

The New C-6 Waco 4-5 Place Cabin

(See front cover)

Side elevation of the new C-6 Waco cabin job that is attracting much attention.

MANY refinements have been made in the new Waco C-6 which add greatly to the comfort of the pilot and passengers and to economy and ease of operation.

The Waco C-6 cabins are quieter and roomier than ever before and plenty of room is allowed for luggage in a compartment that can be loaded through an outside door. The landing-gear has been given greater travel, smoothing out landings on rough fields and the shocks in taxying.

As will be seen from the colored drawing on the front cover, the design is very attractive. This particular ship is the first in the Berryloid Fleet being featured in a model competition currently being conducted by Berry Bros.

The C-6 Series is offered with the choice of six power-plants, Continental 225-240 hp, Jacobs 225 hp, Jacobs 285 hp, Wright 250 hp, Wright 285 hp and Wright 320 hp. Many of the dimensions, of course, including the weights vary with the powerplants employed. All of the engines mentioned are seven cylinder radials, air-cooled.

When equipped with a Jacobs L-4, the span of the wings is 35'-0" and the total length is 26'-8". This gives a top speed of 159 mph, with a cruising speed of 140 mph. The landing speed is 52 mph, and the climb is 760 feet per minute. With a Wright 320 hp engine, the top speed is raised to 176 mph and the rate of climb to 1,000 feet per minute.

Miss "Streamline's" Anniversary

MISS STREAMLINE, known to aviation fans from coast to coast as the General Tire and Rubber Company, has just completed her 1,000,000th mile in the interest of her owner.

She is a Lockheed "Vega," piloted by Ray W. Brown since her infancy and her picture was printed some time ago in P. A. when she first started out on her career. Left to right in the picture are William Ong, air-race referee; James Ewing, Director of the Mile High Races; Joseph Cavanaugh, Denver General Tire distributor, and I. C. Rabtoay, General Tire Denver manager.

Officials of the General Tire and Rubber Company celebrating Miss Streamline's anniversary.

Stress Analysis Made Painless

Graphical stress analysis, by which stresses can be computed by diagrams instead of direct calculation.

by RAOUL J. HOFFMAN

A WEIGHT, a load, a force or a stress may be represented by a straight line in a determined position, and their magnitude by the length of the straight line.

The length of this line may be so many pounds to an inch or it may be drawn to any other convenient scale. If necessary, an arrow at the end of the line may indicate the direction in which the force acts, or it may be designated by a plus or minus sign, the plus sign to show tension, and the minus compression. All the forces in the accompanying sketches are drawn to scale No. 12.

The graphic representation of two forces acting at a point O with a magnitude of OA and OB, denoted by F1 and F2, as shown in Fig. 1, will give us the resultant R by drawing parallel lines through A and B forming the parallelogram O-A-C-B-O, and connecting the intersecting point C with O; the magnitude of the resultant is the distance O-C, measured on scale No. 12.

The formation of the parallelogram can be omitted by constructing the triangle of forces shown in Fig. 2. Draw a parallel line of equal length; follow with F2 in the same manner; then the closing line will give you the resultant R, its direction opposite the direction of the forces.

Above procedure can be repeated in order to find the resultant of any number of forces acting at the same point. Fig. 3 and Fig. 4 show an example; the closing line in each triangle is omitted—shown in dotted lines—to save time. The forces can be joined in any order, but for simplicity they are connected in clockwise order to eliminate errors. The multiple of force-triangle is called force polygon.

If the resultant is zero the forces are in equilibrium. The force polygon will close; there is no gap left for a resultant, except the diagram is laid out carelessly.

A single force—see Fig. 1—may be resolved into two component forces in the same plane, anywhere on R, by reversing the operation described above; by repeating the operation with the components, R may be resolved into any number of component forces if the directions are known and parallels are drawn at the other end of the given force.

This resolution of forces finds an application for plotting the resultant of any aerodynamic item; one component is in line with the direction of the relative air motion, called the drag, usually horizontal, and the other in line with the gravity, 90° to the drag, called the lift. In case the forces are referred to

Elementary Graphical Diagrams

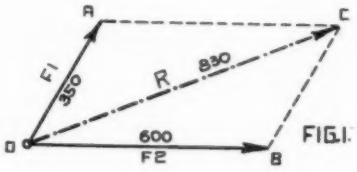


FIG.1.

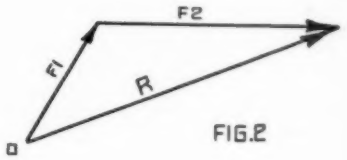


FIG.2

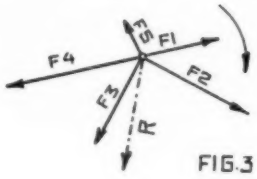


FIG.3

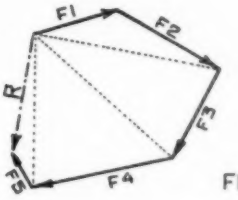


FIG.4

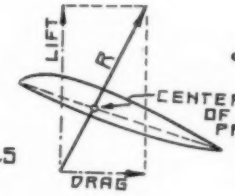


FIG.5

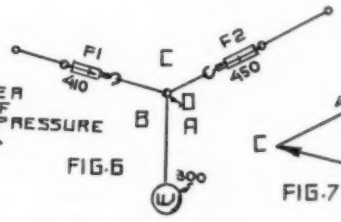


FIG.6

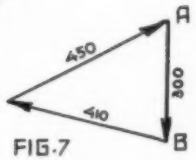


FIG.7

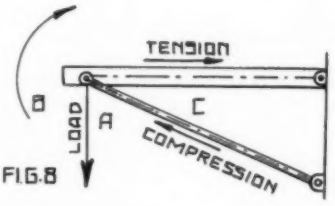


FIG.8

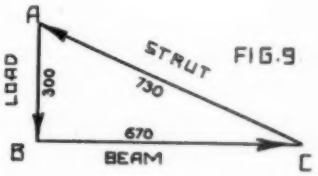


FIG.9

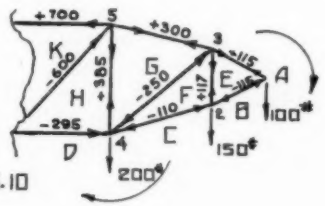


FIG.10

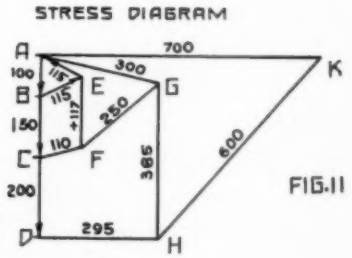


FIG.11

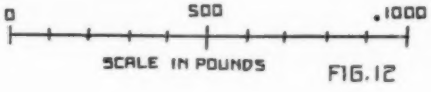


FIG.12

engineering units then the forces become the lift and drag coefficients. Fig. 5 shows the resolution of the resultant.

The equilibrium of the forces of external loads and internal stresses can be found graphically with the aid of the force polygon if the diagram will close, that is, there is no resultant, no line of opposite direction.

To illustrate our problem we take for example a weight attached to a cable, which again is held by two cables pulling sideways, as shown in Fig. 6; this we may call the space diagram.

Let O be the joint of the unit, W the weight, and F1, F2 the stresses to be found. Placing letters between each member, we may again denote W as a force lying between A-B, F1 between B-C, and F2 between C-A. Then we can proceed with our stress diagram, as shown in Fig. 7. Drawing the load W from A to B; then from B, following clockwise, draw a parallel with F1, following it with a parallel with F2 to pass through A in order to close the diagram. The intersecting point C will give you the stresses F1 and F2 measured on scale No. 12. The arrows to "go round" the same direction.

Checking the direction of the arrows in the stress diagram with the scale drawing and viewing point O, we find that all arrows point away from the joint O, which indicate that all members are in tension.

Another example is worked out in Fig. 8 and Fig. 9 showing one side of a motor mounting, with a load of 300 lbs. at the joint. The laying out of the stress diagram is the same as in above example; it is the joining of parallels drawn to the members in clockwise order. Checking the arrows we find the arrow B-C in the stress diagram pointing to the right, which will point in Fig. 8 away from O; therefore the member is in tension; the arrow C-A points upwards, which in Fig. 8 points towards the joint and indicates the strut is under compression.

This method can be applied to framed structures if any force or stress can be resolved into two components; then the structure is determinate; if there are more than two members unknown, then the structure is indeterminate and requires the use of flexure formulas.

A scale drawing of a side of a fuselage with three loads applied at various panel points is shown in Fig. 10. Letters, placed between members, will designate the forces; always measured on scale No. 12.

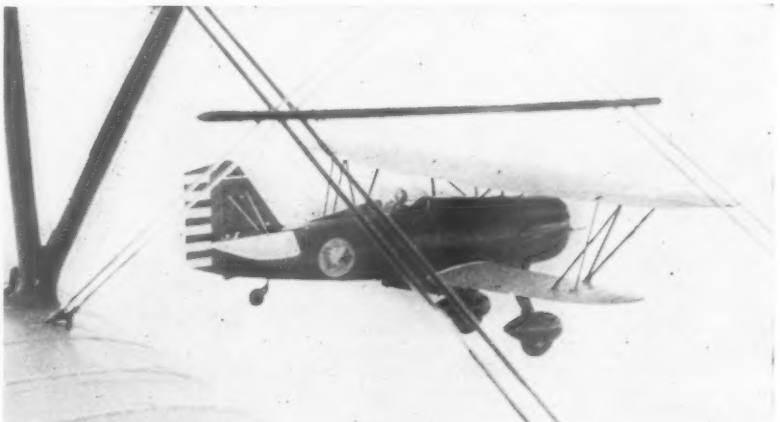
Draw the stress diagram—Fig. 11—by beginning with load A-B, and following clockwise with a line at B parallel with B-E and a line at A parallel with E-A; then proceed to joint 2; E-B is known (read member in clockwise order), add B-C at B, and at C a parallel with C-F; then a vertical from E, parallel with F-E will close our diagram for joint 2.

Then follow the joints in numerical order, draw your parallels in the same manner as above indicated until all

(*Concluded on page* 69)

Analysis of Aircraft Alloy Metals

by JAMES P. EAMES



The structural members shown here represent many varieties of aircraft alloys each of which must be subjected to analysis.

METALS employed in aircraft construction and repair are generally received from the manufacturer accompanied by an affidavit testifying that the material conforms to the specifications designated by certain definite requirements.

However as it is easily possible to misplace or mislabel such material in stock, it often becomes necessary, due to practically unavoidable mistakes on the part of a shop force, to reclassify structural sections and members.

The following simple and authentic tests will enable the mechanic or inspector, upon their performance, to satisfactorily identify the steel and aluminum alloys commonly encountered in aircraft practice on the basis of their chemical composition.

The presence of chromium, as in the nickel-chromium and chrome-molybdenum steel alloys, may be detected by simply dissolving one-half gram of filings from an annealed specimen of the metal in ten cubic centimeters of a twenty-five percent. solution of sulphuric acid. This acid solution is prepared by the dilution of concentrated sulphuric acid in the proportion of one part to three parts of pure water. Should chromium be present, the solution will turn a deep green color.

The presence of nickel in alloy steels is detected by first thoroughly cleaning a small area on the surface of the metal specimen to be tested, and then dropping on this prepared section a sufficient quantity of fifty percent nitric acid solution to completely cover it. The acid solution is prepared by the dilution of one-half pint of concentrated nitric acid with one-half pint of pure water.

When the acid has remained on the section approximately two minutes, it is absorbed with a small pad of blotting paper, and a few drops of dimethylgloxime solution applied to the paper. Should nickel be present, the paper will turn a fairly dark shade of reddish pink.

In the absence of nickel content a brown color is produced on the paper. The dimethylgloxime solution is prepared by dissolving one gram of dimethylgloxime in 75 cubic centimeters of acetic acid, 30 cubic centimeters of concentrated ammonia, and one gram of ammonium acetate.

Modern aircraft construction employs aluminum as a structural material both in its pure state and as a copper-bearing alloy, the former because of the high degree of corrosion resistance incorporated in its characteristics, the latter material due to its greatly increased strength characteristics.

The universally-used "Alclad" represents a composite of the two above-mentioned materials, the inner core of duralumin sheeting being coated with a surfacing of 99 percent. aluminum. Should it become necessary to distinguish one of these materials from the other, performance of the following test will readily enable the mechanic to do so.

A test solution is prepared by dissolving 250 grams of caustic soda in 750 cubic centimeters of pure water. For ready convenience in the average shop the proportions of this solution may be expressed in the more commonly employed units of approximately 12 ounces of caustic soda to one quart of pure water. When this solution is applied to the metal the chemical action is fairly rapid and identification becomes possible in a few minutes, the pure aluminum remaining silvery white while the duralumin turns black.

Where the necessary equipment is available, aircraft construction materials may be readily identified also when subjected to physical tests. If, for instance, it is desired to distinguish between fuselage longeron members composed of

(*Concluded on page* 71)

Something New in Self-Starters

A very original yet effective type of self-starter has been developed which at one time is reliable, light in weight and easily handled

A NEW "Rocket-Charge" Engine Starter, built specially to the needs and weight requirements of aircraft, has recently been put on the market by the Federal Laboratories, Inc., of Pittsburgh, Pa.

This starter, presented to the trade as the Coffman Engine Starter, underwent rigorous self-imposed laboratory tests as well as the gruelling service requirements of Army and Navy flying before being introduced to commercial aviation. Judging from the results obtained it marks another great step ahead in internal combustion engine refinement.

The new device lays claim to success on three vital points: simplicity of operation, positive action, and weight economy. And in meeting these three requirements it stands to eliminate another of the few remaining drawbacks in simplified aircraft operations.

The principle of operation, simply put, is rocket propulsion. A "charge" of patented, gas-generating fuel is used to impel the starter. The small "rocket-charge" is inserted in a breach, conveniently placed in the instrument panel, is "fired" by the touch of a button and the gas pressure generated is delivered to the burning chamber by a specially constructed conduit. The result is smooth, cushioned power free from shock to the engine crank-shaft.

Once the charge is "fired" all that is heard is a gentle swoosh until the engine begins barking.

Simplicity of operation is achieved in that there are only eight moving parts to the starter, all of which move at extremely slow speeds. The piston, as has been intimated, is motivated by gas expansion rather than by explosion. And it is ingeniously geared to spin the propeller at 200 R.P.M. as it moves a short five inches. Interesting to note, too, one of the eight moving parts is a safety valve, installed merely as a precaution.

Its positive action has been demonstrated repeatedly under all simulated weather conditions. In the laboratory ice-box this starter never once failed to turn the motor at temperatures ranging down to minus 30 degrees Fahrenheit. Once the rocket-charge is ignited (a single-cell flashlight battery will do), it is certain to burn.

During last winter's G.H.Q. Air Force maneuvers in Vermont, it demonstrated its superiority in extreme winter conditions. It was so cold at Fort Ethan Allan that all of the storage batteries froze and carburetion was extremely difficult. The Air Corps officers had many an occasion to be thankful for the newly developed aviation starter.

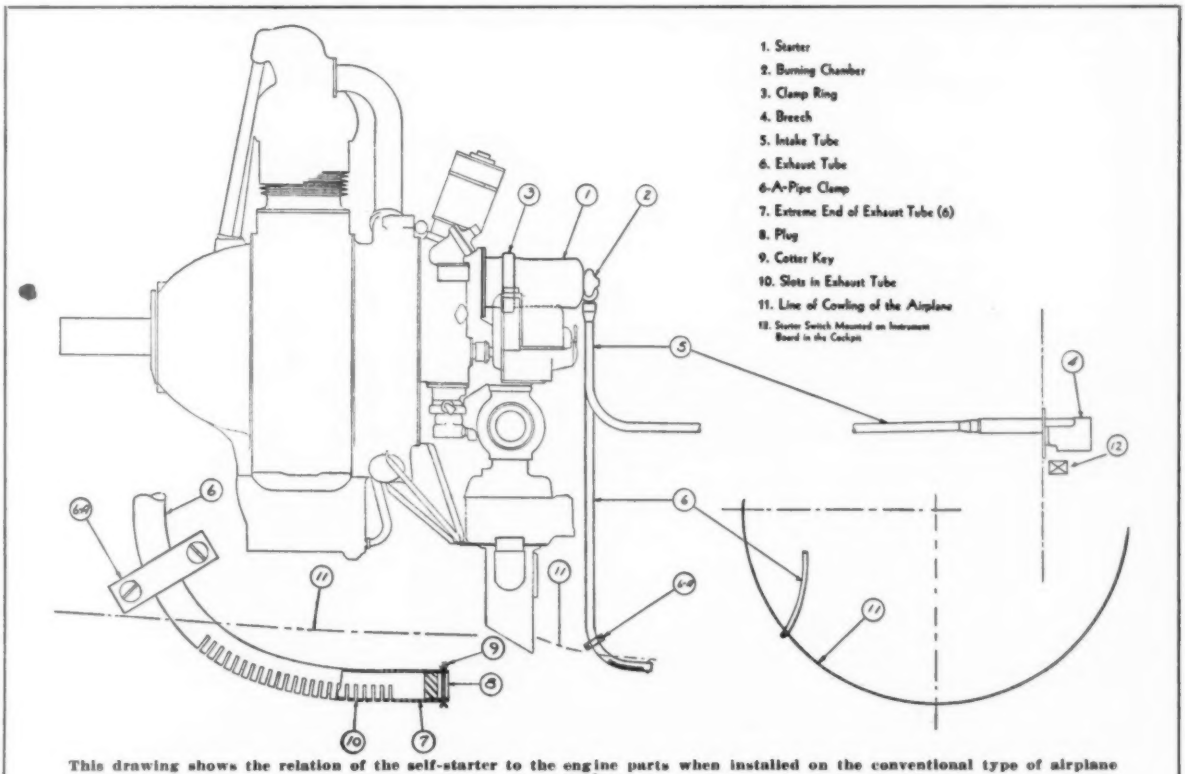
It shouldn't be presumed that the "rocket-charge" starter is limited to sub-zero temperatures. Naval aircraft engines, operating on the carriers, have found it equally efficient in tropical dampness; the only difference in warm climes being that a lighter "charge" is made for these conditions.

From commercial aviation's standpoint the weight economy probably means more than the other two attributes. Gone are the booster magnetos, the heavy inertia wheels, not to mention the weighty batteries.

Each Coffman starter stands to save from 10 to 69 pounds per engine, depending on the installation. And in the case of the big multi-motored ships, the extra pay-load may mean the difference between profit and loss.

At present two types of Coffman starters are available, one for engines up to 450 H.P., and the other for those up to 1000 H.P. The "rocket-charges" are being made available at airports everywhere in cartons of twenty each. They somewhat resemble a shot-gun shell, yet are non-explosive, safe to handle and perfectly stable in any climate.

END.


1. Starter
2. Burning Chamber
3. Clamp Ring
4. Breech
5. Intake Tube
6. Exhaust Tube
6-A-Pipe Clamp
7. Extreme End of Exhaust Tube (6)
8. Plug
9. Cotter Key
10. Slots in Exhaust Tube
11. Line of Cowling of the Airplane
12. Starter Switch Mounted on Instrument Board in the Cockpit

This drawing shows the relation of the self-starter to the engine parts when installed on the conventional type of airplane engine.

"Early Birds" Hold Last Rites for Ovington

The attending "Early Birds," old-timers in aviation.

WHILE his widow and daughter watched from the lawn of their home in Sierra Madre, California, members of "Q. Bs." and "Early Birds" flew overhead with the ashes of Earl Ovington, pioneer airmail pilot.

The ashes of this famous old pilot were carried in the leading plane piloted by Art Klein. There were six planes in all.

After circling low over the Ovington home, the planes flew off in single file to a point about a mile offshore from the ocean front at Santa Monica. Here the ashes were dropped through the low-hanging clouds to the waters of the Pacific Ocean.

The six planes returned from the aerial funeral to Grand Central Airport in Glendale, California.

Smallest Racing Plane in the World

WITH a total span of only 12 feet, and with a fuselage only slightly longer, the little racing plane pictured above is still capable of speed in excess of 200 miles per hour.

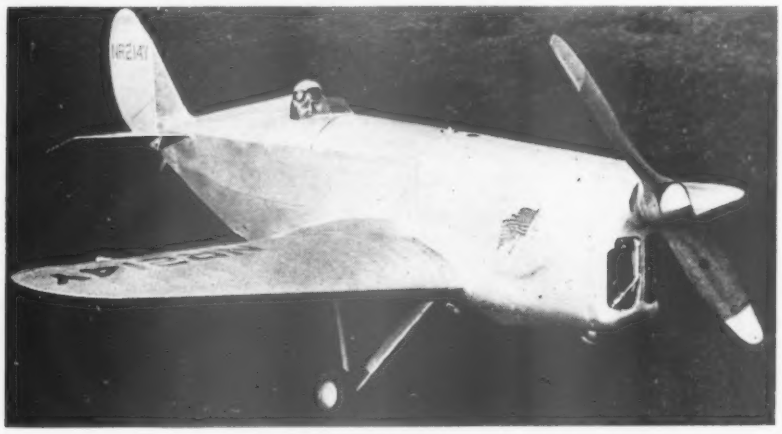
Powered with a Martin inverted, air-cooled, in-line engine of only 120 h.p., it can show its heels to many of its more powerful rivals. The engine is one of the three of this type ever produced.

There are several novel construction details present in this plane. For example, it is the first racing plane ever built which incorporated trailing edge wing flaps in its original design. It has a fixed stabilizer.

The tail surfaces, both vertical fin and rudder, and stabilizer are extremely small in total area, especially when compared to a plane of conventional size. The closest comparison one can imagine is that of the French Mignet "Pou du Ciel," or Flea.

Its wing is full cantilever, and forms an integral part of the fuselage. It is formed of steel truss members throughout. With the bottom center section of the wing forming the bottom of the fuselage at that part, one can readily conceive its sturdy construction. Hollow steel tubing is used both in the fu-

(*Concluded on page* 63)



This clean-cut miniature racing job should bring home the bacon in almost any contest.

Spartan Adds to Equipment

NOW included in the equipment of Spartan School is the all-metal low-wing Spartan Executive model four-place cabin, giving members of the Dawn Patrol the latest word in aviation instruction.

Transport students fly this modern plane with its hydraulic operated flaps and retractable landing gear, and every Spartan student works as an apprentice mechanic in the Spartan Factory in the construction of the Executive model, side by side with experts in every line from designing to final tests."

Largest and the Smallest

TWO aircraft engines using the same name are now in everyday use in the United States. The larger of the two is the Wright Cyclone, Model G5, of 1,000 horsepower. It is of the type being used on the new Douglas Sleeper Transport.

This huge engine, the largest, single row radial, air-cooled engine in use in this country, weighs 1,170 pounds. It has a top maximum of 2,200 revolutions per minute. Its diameter is 53¾ inches.

The "Baby Cyclone" is a miniature engine being produced in Southern California for use in the increasingly popular gas-engined model airplanes.

For comparison with the big Cyclone, the Baby Cyclone is rated at 1/5 horsepower. It is an aircooled, one cylinder, rotary valve engine with a weight of 10½ oz.

High Life in Vienna

JOSEPH MARKOVICS, 19 Muren Avenue Vienna X, has them standing on their toes in Vienna, so they say.

Mr. Markovics, according to the legend reaching us from Europe, throws this model up into the air and, from that time on, the model continues to fly by virtue of the articulated wing structure which evidently is of the flapping type.

Here's Joseph and his model.

Hints for the Home Builder

This is the second article in which the author gives the home builder many helpful tips and suggestions that will be welcomed by beginners.

by G. E. McPHERSON

In the September issue, the author gave instructions on the preliminary factors entering into the layout of the plane and the estimation of weight for the preliminary calculations. He emphasizes the fact that weight distribution in a light-plane differs from that in the large plane.

The experienced designer has certain information at his disposal which is based on experience, and he has combined this into empirical formulas for the determination of his weight. Unfortunately the light plane builder rarely has these at his disposal. For one thing, there is a great difference in the weights of the various engines used in light aircraft. For another thing, the average heavy ship is either a two place or a three place ship, except in the case of the large cabin airliners. The light ship is never over two place and is rarely over a single place ship. Naturally the percent. of weight taken up by the pilot varies greatly with the conditions. In Table I, I have given a few figures which may be used as the basis for rough calculations. These figures are approximate and are not to be taken as being exact by any means. They are to serve merely as a basis or guide for your own figures in case you wish to take up this problem in detail. In Table II, I have given a set of weights for tubing and spruce which are exact as far as I am able to determine. In no case are they incorrect more than a fraction of an ounce. For your rough calculations as to weight you may use Table I. This will tell you approximately how much each part should weigh. Now, if you wish to thoroughly check your ship, you should take the figures given in Table II and make your calculations. These should be made very carefully and as accurately as possible. For instance, if you have 68½ feet of ½ inch, 20 gauge tubing in the fuselage, it will weigh 11.78125 lbs. It is best to drop the last three figures in this case and call the weight 11.79 lbs. or even 12 lbs. Always make the weight a trifle more than it actually is rather than a trifle less. If you estimate your ship in this way and the figures come out to around nine hundred pounds you can be quite sure that a forty-five horse motor will tow her. Then, after it is built, you can weigh the completed ship and if it weighs only eight hundred and fifty it is a cause for rejoicing. It is much better to have it fifty pounds underweight rather than fifty pounds overweight. IF YOU HAVE KEPT ALL THE MEMBERS THE REQUIRED SIZE!! You must never, under any circumstances, make any of the structural members smaller than the design calls for merely to save a few pounds of weight.

We next come to power and wing loading. In the case of the ship mentioned at the beginning of this article the power loading was too great. That was one of the reasons it wouldn't fly. Power loading and wing loading are very simple and easy to understand, yet very few light plane fans know what they mean. The power loading is the ratio between the horsepower and the weight of the ship, and is found by dividing the weight by the horsepower. Thus, if you have a ship weighing nine hundred pounds and it is powered with a forty-five horsepower motor the power loading is twenty. This means that each horsepower of the motor must carry twenty pounds. The lower the power loading the better the ship will climb, the higher the top speed will be, and the better it will perform generally. There are a few cases where the power loading has run to twenty-four pounds per horsepower and the ship flew, but these cases are the exception rather than the rule. The average commercial ship has a power loading of approximately fifteen to eighteen.

Wing loading is very similar. In this case it is the ratio between the wing area and the weight of the ship. It must be remembered that these weights are all weights loaded, ready to fly. The wing loading is found by dividing the weight of the ship by the area of the wing in square feet. Wing loading has a very definite relationship to the landing speed. The higher the wing loading the higher the landing speed will be. The wing loading for the average light ship lies somewhere between four and six. A wing loading of four will give you a landing speed of from thirty to thirty-five miles per hour, and a wing loading of six will give a landing speed of from forty to forty-five miles per hour.

This landing speed is also dependent upon the particular airfoil or wing curve used. When the designer chooses the airfoil for his ship he is very careful to pick one which will give him the best all around performance. If the ship is a heavy cargo or passenger ship, he picks one of the thick, high lift, slow speed airfoils, and if it is a racing ship he will pick a fast, very thin airfoil. If it is an all around ship he will try to pick one which will give him the best possible cruising speed with a low landing speed. The study of airfoils is a special study in itself and we shall not attempt to do more than scratch the surface here.

Every now and then we find an article on airfoils and we clutch it eagerly as we hurry to the easy chair. At last, we say to ourselves, we're going to find out what it's all about. We open the magazine and find that some learned gentleman is discoursing fluently about Reynolds numbers, lift components, drag components, and beam-to-chord ratio. At the end of half an hour we hurl the magazine into the stove, curse the author of the article bitterly, and go into

TABLE I.

Ford "A" Powered Jobs

Single Place

Engine	30.0%
Radiator and water	6.0%
Pilot	20.0%
Wings	12.0%
Fuselage	6.0%
Chassis	6.0%
Tail group	4.0%
Gasoline	7.0%
Oil	2.0%
Tanks	2.5%
Misc.	4.5%
Total	100.0%

Two Place

Engine	24.0%
Radiator and water	5.0%
Pilot and passenger	32.0%
Wings	12.0%
Fuselage	5.7%
Chassis	5.7%
Tail group	2.6%
Gasoline	6.0%
Oil	1.5%
Tanks	2.5%
Misc.	3.0%
Total	100.0%

Aircraft Motor Powered Jobs

Single Place

Engine	22.0%
Pilot	25.0%
Wings	14.0%
Fuselage	8.0%
Chassis	8.0%
Tail group	4.0%
Gasoline	9.0%
Oil	2.0%
Tanks	4.0%
Misc.	4.0%
Total	100.0%

Two Place

Engine	16.0%
Pilot and passenger	37.0%
Wings	13.0%
Fuselage	6.0%
Chassis	6.0%
Tail group	3.0%
Gasoline	7.0%
Oil	2.0%
Tanks	3.0%
Misc.	7.0%
Total	100.0%

XUM

the street determined to get a job driving a garbage truck.

In order to understand the principles of airfoil operation and selection, it is necessary to have a fundamental knowledge of aerodynamics. I think that every lightplane builder knows that there are two forces acting on an airfoil, known as lift and drag forces. These forces are nearly perpendicular to, and parallel to, the chord of the airfoil in a zero angle of incidence condition. The lift components and the drag components of an airfoil are determined by wind tunnel tests and then plotted in the form of curves. These curves are of great interest to the student of aeronautics and should be studied very carefully.

You will notice that the points of reference are labeled angle of attack in degrees. It is very important that the student or the builder thoroughly understand the difference between angle of attack and angle of incidence. Several reputable textbooks are very vague on this point. One book on stress analysis, for instance, keeps stressing members for the high angle of incidence condition when it should be high angle of attack. Angle of incidence is the angle to the horizontal, or line of thrust, at which the wing is mounted on the fuselage. The angle never changes at any attitude of flight. The angle of attack is the angle at which the wing meets the relative wind. This angle may change frequently with the various attitudes of flight. In level flight the angle of attack will usually be very close to the angle of incidence and is sometimes equal to the angle of incidence. In pulling out of a dive, however, the angle of incidence remains constant while the angle of attack may change to as high as fifteen or twenty degrees.

When a ship is coming in for a landing, assuming it is a three point landing and not a level landing, the angle of attack is usually quite large. Therefore, when figuring landing speeds, they should be figured for high angle of attack. In his calculations the designer looks for the high angle of attack and reads his lift component directly, and is then able to make his calculations. It can readily be seen that the drag component need not enter into the landing speed as landing speed is merely the minimum speed at which the lift is great enough to support the airplane.

The next step in the designer's process is to build a scale model of the ship. For the average lightplane fan this is hardly necessary. However, if you really wish to have a better idea of how the completed ship will look, it is a very good idea to build a model.

The designer next builds a mock-up. This is an excellent idea for the builder to adopt. Your plans are designed to give you a maximum of comfort and visibility but sometimes you can make improvements to suit yourself. If the rudder bar or pedals are too close for comfort you can always move them farther ahead without changing the fundamental characteristics of the ship. The same can be done with the height of the seat. The important thing to be remembered is that the structural members of the fuselage should never be changed. This might lead to serious weakening of the structure.

A mock-up is very easy to build. Many builders draw an outline of the cockpit on the basement or garage floor and then pile up a few boxes and boards to simulate the seat. Sides can be constructed of boxes in order to determine the visibility, and, by taking measurements of the plans, and placing a bar at the proper point for the rudder pedals, you can easily determine whether or not you will be comfortable. If you are building a parasol monoplane you don't have to make allowance for the wings in order to determine the visibility.

The designer's sixth step is the building of the scale model for wind tunnel tests. This is also unnecessary for the lightplane builder. In nine cases out of ten the designer of the plans has already run wind tunnel tests, or, if he hasn't, he has flight tested it enough to have a pretty good idea of its characteristics. Another thing against this is the difficulty for the average builder to run wind tunnel tests. However, if you have built a small wind tunnel for your own experimental work it might prove interesting to try a few tests to see for yourself what happens.

There have been a number of good articles recently on making balance diagrams, and it is hardly necessary to go into that again. In some cases the builder wishes to make a balance diagram in

(*Continued on page 60*)

TABLE NO. 2

APPROXIMATE WEIGHT PER FOOT OF SPRUCE STRIPS

SPRUCE—27 lbs./cu. ft.

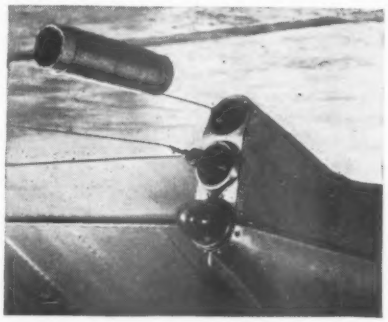
¼" x ¼"	0.012
¼" x ½"	0.024
¼" x 1"	0.046
⅜" x ⅜"	0.024
½" x 1"	0.092
½" x 2"	0.184
½" x 3"	0.276
½" x 4"	0.368
½" x 5"	0.460
½" x 6"	0.552
¾" x ¾"	0.105
¾" x 1"	0.141
¾" x 2"	0.282
¾" x 3"	0.423
¾" x 4"	0.564
¾" x 5"	0.705
¾" x 6"	0.846
1" x 1"	0.189
1" x 2"	0.378
1" x 3"	0.567
1" x 4"	0.756
1" x 5"	0.945
1" x 6"	1.134

TABLE 2A

WEIGHT PER FOOT OF ROUND STEEL TUBING

Ga.	Outside Diameter ¼"	⅜"	½"	⅝"	¾"	1"
22	0.066	0.104	0.141	0.179	0.220	0.290
20	0.081	0.127	0.172	0.221	0.270	0.360
18	0.105	0.171	0.236	0.302	0.370	0.500

An Auxiliary Radio Antenna



The Auxiliary antenna.

THE development of an auxiliary radio antenna to supplement the standard trailing antenna for simultaneous or independent use and which is shot out into space at the will of the pilots, has been completed in the maintenance department of Transcontinental & Western Air, Inc.

If the regular antenna is not giving the desired reception or transmission, the auxiliary unit can be released for simultaneous use. The switch throws the auxiliary antenna in parallel with the regular antenna and it may be used in this manner without affecting the signal strength of the transmitter or the reception of the 2-way receiver. In fact, while operating on day frequency, it actually increases the signal from the transmitter.

In order to permit the installation of this auxiliary antenna, a new casting was designed in order to house the portable unit directly beneath the regular unit, slightly altering the shape of the tail cone.

The portable auxiliary unit consists of a cylinder having a compression spring and trigger. There also is an electrical switching mechanism, which, when loaded with the antenna cartridge and released by an Arens control, shoots out the cartridge and closes the electric switch putting the auxiliary antenna into immediate use.

When the control is released, a compression spring forces a paper cylinder out into space upon which is wrapped 35 feet of No. 16 steel control cable which serves as the antenna wire. The antenna wire ravels and discards the cardboard tube upon which it is wrapped when packed in the cylinder. The paper cartridge is approximately 1¾ inches in diameter and is held in place against the compression spring by a trigger. The entire unit is covered over by a wax paper cover which is torn open when the trigger is released.

A special loading tool is used to reload the cylinder with a new antenna cartridge when the unit is repacked. The entire unit, including the special tail cone casting and all the parts weighs between 4 and 5 pounds.

This will undoubtedly do away with many of the accidents that have occurred in the past with the conventional types of trailers that have been used from time to time. It is positive in action and not likely to entangle itself as many previous auxiliaries have done.

The 1936 Texaco Gas Model Events

by

HERBERT J. GREENBERG

SINCE its beginning in 1932, when Maxwell Bassett flew a gasoline-powered model airplane in an outdoor contest event for the first time, gas-model aviation has progressed in great leaps.

Designs of gas jobs have come and gone with the passage of the last three years. This year's Texaco event at the National Model Airplane Champion Contest, which was held in Detroit, Michigan, on July 1, has brought forth new ideas and certain changes which, though not being radical in pattern, have served to produce more efficient and consistent flying models.

Certainly, the fact that more builders had models remaining in the air for durations of greater than ten minutes, than did those builders who attended last year's contest, indicates that progress has been effected.

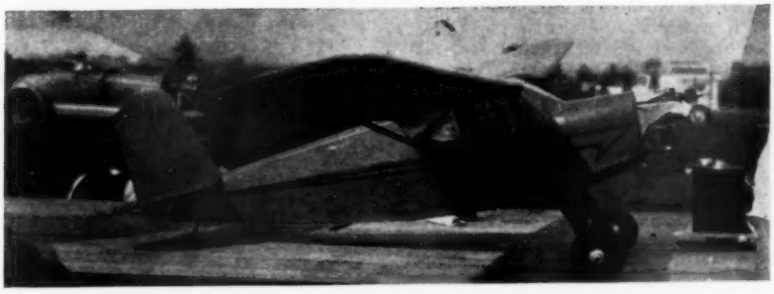
Circumstances seem to confirm the correctness of the belief of certain builders that in a few years the rubber-powered outdoor model will be almost obsolete. At each successive gas-model contest held, more and more gas jobs are seen.

The Texaco event at the 1936 nationals has substantiated this belief, for there were more than one hundred contestants entered in the event and a far greater number of models.

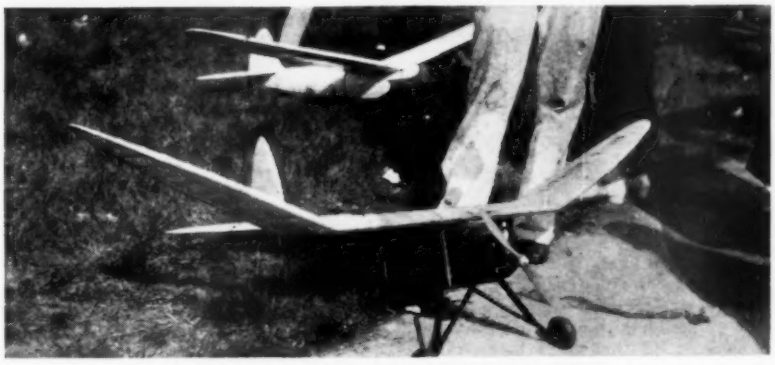
It is clearly evident that the interest in this phase of model aviation has grown to almost abnormal proportions, when one considers this fact and also witnesses the number of spectators who attend the meets. The Detroit Times, sponsor of the contest, gave the gas event full publicity days before it was run-off, and this advance information attracted thousands of people throughout the day of the contest.

Weather conditions as in previous years were practically perfect. The sky was a clear blue, no clouds at all prevailing. Once a model reached a high altitude, it was easy enough to keep in sight. Only one or two gas jobs were lost because of the judges' inability to keep them within the range of normal vision. Thermals were to be found in certain places, and after a model had reached a sufficient height it was almost certain to be carried by these currents to greater altitudes and distances.

The Wayne County airport at which the meet was held is ideal for a gas-model or any other. It extends in one direction for about a mile, and in another direction for about half a mile. The territory outside of the airport is flat and



A gas driven scale model of the Rearwin which shows excellent design.



Mike Roll's gas job with his polyhedral wing idea.

A gas powered biplane built by Donald Krauss of Erie, Pa.

Herbert Greenberg, the author, and his ship.

consists of farm land and scattered clumps of trees.

Roads lead in all directions throughout this area so that there is little fear of losing a model due to the impossibility of following it. A number of concrete runways on the airport proper served admirably as take-off spots, but most of the contestants preferred using the grassy portions of the field rather than risking cracking up their ships on the concrete.

Automobiles were used to follow the models, and these were quite scarce as it was difficult to obtain the three official flights in less time than six hours. The writer waited two hours after receiving his first official flight for the opportunity to fly again.

The same predicament is encountered at most other gas meets. One would think that the contest authorities would try to avoid this trouble by making the necessary arrangements before the event for the provision of a sufficient number of automobiles with which to follow the models.

It might be wise, for the success of future contests, to organize a committee of interested individuals whose duty it is to see that adequate means of following models is provided, or, if difficulty in obtaining a sufficient number of drivers and cars is met with, to call for volunteers among the spectators.

Flights were taken quite early in the day as builders sought to bring their models up to their best flying adjustments, and a number of beautiful flights were witnessed by the crowd. Crack-ups were not as frequent as they have been in previous contests. This fact alone indicates that the model builder is learning more about good adjustments and design. Throughout the morning and early afternoon reports of twenty-six minute, thirty minute, and thirty-six minute flights were passed around.

When word came from Mr. Howard Snyder who followed Frank Tlush's gas job that the latter's model had flown for over forty-five minutes, everyone knew that that mark would be hard to surpass. By the end of the day when results were checked, it was found that Frank had come out on top in the Texaco event.

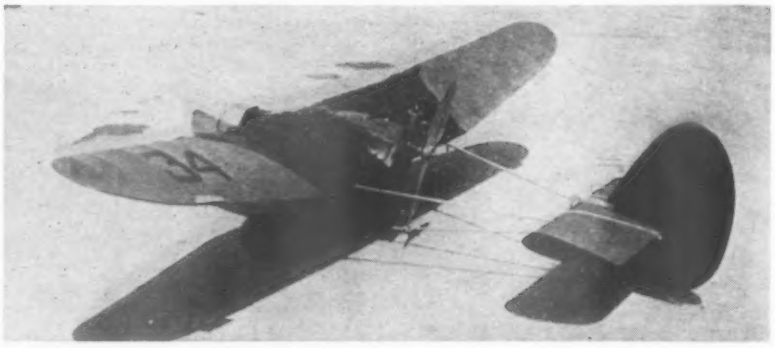
The interesting fact about the winning flight is that the model, after flying for about nine minutes under the power of the engine came down to within a very short distance of the ground after dropping in altitude over a patch of trees, and then hit a thermal current and was lifted to an altitude of over a thousand feet to soar for the remainder of the flight time.

The engine, a Tlush Super Ace, was built by Frank's older brother, Charles. The ship was streamlined throughout and of simple design.

Leo Weiss, last year's Texaco event winner, failed to place in the contest because of trouble he had with his gas job. The model, a beautifully built, all wood, streamlined job took off and lost a wheel. This unbalanced the model slightly and caused a bad landing.

(*Continued from page* 69)

The First Gas Model Pusher



Here's a rear view of the pusher gas model which should lead to interesting developments.

THE photograph shows one of the first gas model pushers ever made. It was built by a Hollywood man and has a span of five and a half feet. The wings and tail surfaces are built of balsa covered with silk, while the spruce fuselage has a sheet metal and silk covering. The tail booms are metal tubes.

Powered by a Baby Cyclone engine, the pusher has excellent flight characteristics, the gradual take-off and smooth landing being very realistic.

The Waste and Uselessness of Air Races

By JOHN B. RATHBUN

OUR racing fans were highly incensed by my story of the Air Races, presented in the November, 1935, issue of POPULAR AVIATION. Letters of protest came pouring in, which greatly pleased me as it gives me reason for again opening a subject that would otherwise have remained closed—at least for a considerable time.

In one way, I am fully in sympathy with the irate boys, for I was once a racing fan—and an active one—when I was much younger. I fully understand the urge that dictates such replies. I used to write such letters to the editor myself when I was raving under the feverish racing delusion—back in the time of the Vanderbilt Cup Races and the Michelin Coupe when men were killed off like flies and with about as little consideration. I was sure determined to get lamed up myself, or know the reason why! Perhaps this is one of the prominent symptoms of "flaming youth"!

But, after twenty-five years of contact with automotive racing, of various sort and in various capacities, retrospection fails to disclose any good that ever came from racing, either mechanically, physically, financially or in any other way. Out of the few old time racing men left, Barney Oldfield stands as a prominent example, because Barney quit when the quitting was good. His judgment told him that there was nothing more to gain and everything to lose by further racing.

At the same time, the majority of automobile manufacturers became convinced that racing was detrimental to their business and quit. Locomobile and Simplex, once star performers on the track, appeared no more in races sponsored by the builders.

Many other makes of cars, once glorified as victors at track and road races, are now extinct. Among these are the Gaeth, Chadwick, Pope-Toledo, Marion, Stoddard-Dayton, Lozier, Tincher, Rutenburg and others. They were developed in the wrong direction and were no longer in demand when the period of private ownership appeared. Their stamina, gained at the race-tracks, was of no avail to the private owner.

Many readers have inquired why I introduce automobile racing into the argument. The reason is very simple. From a commercial standpoint, automobiles and airplanes are directly comparable and it is this merchandising angle that is of prime importance today. If airplanes cannot be sold, then there is little use in building them and, therefore, P. A. is intensely interested in their commercial development and condemns any condition that blocks this field. While we are not a trade paper, nor essentially commercial, yet our existence depends indirectly upon airplane sales which, in the final analysis, depend upon utility.

Automobiles and airplanes, as we have stated before, are directly comparable. Both are automotive vehicles propelled by gasoline engines. Both vehicles have been hindered by similar patent situations and patent litigation. Both are produced by approximately the same class of manufacturing equipment. Both are distributed and sold by approximately the same methods. Both should appeal to the same type of customer. And, finally, both have been the victims of the racing and stunting mania.

I first wish to call your attention to the fact that the automobile is not so very much older than the airplane and

(*Continued on page* 64)

Building the Hawker Merlin

by

PAUL W. LINDBERG

Model Editor and Model designer for POPULAR AVIATION

This realistic model of the Hawker Merlin, when completed, will be a reason for satisfaction both in appearance and in performance. It is an exceptionally fine flyer.

THE Hawker Merlin is a new addition to the British Air Force. High speed plus real streamline make this attractive model an exceptional flyer. We know you will enjoy every minute in the construction of the Hawker Merlin.

COLOR SCHEME

Entire model, silver with exception of the front part of fuselage, which is covered with Master Metal Unifoil.

CONSTRUCTION OF FUSELAGE

First, place waxed paper on top of plan to prevent parts from sticking to plan. The fuselage sides are built from 1/16-inch square balsa. The longerons, verticals, diagonal braces, etc., are held in place until securely cemented, by inserting straight pins on either side of strips wherever needed.

When the two sides are completed, the cross-members are cemented into their proper locations. Check carefully front to rear for alignment. Cut the formers from 1/16-inch sheet balsa and cement in their respective positions as shown on the plan.

The positions of all stringers is clearly shown on the formers. See plan. Work stringers from front to rear and check carefully to see that they have the correct spacing.

CONSTRUCTION OF WINGS

Cut all ribs from 1/16-inch balsa. Pin the spar in position on the plan. Now cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs.

The panels carry movable ailerons which are a great help in controlling the flights. Make wing tips from 1/16-inch thick balsa. We highly approve of this type of wing tip, because it is much easier to construct and neater in appearance.

CONSTRUCTION OF ELEVATOR AND RUDDER

These are built from 1/16-inch square and flat balsa, and are constructed on the plan. Their construction is very simple, therefore no trouble should result here.

FILLETS

We have eliminated carving of balsa wing fillets, and have used instead stiff paper wing fillets. To assure proper fitting, a little time is required for trying and fitting fillets to fuselage.

LANDING GEAR

Carefully construct all members to get required strength for struts. All details are carefully explained on plan.

OIL COOLER AND RADIATOR

Build these up as shown on plan. Carve oil cooler from solid piece of balsa wood. The radiator is built up and covered with Master Metal Unifoil.

COVERING THE MODEL

Apply tissue to the various framework members, using a light grade of model airplane dope to fasten it to the outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue.

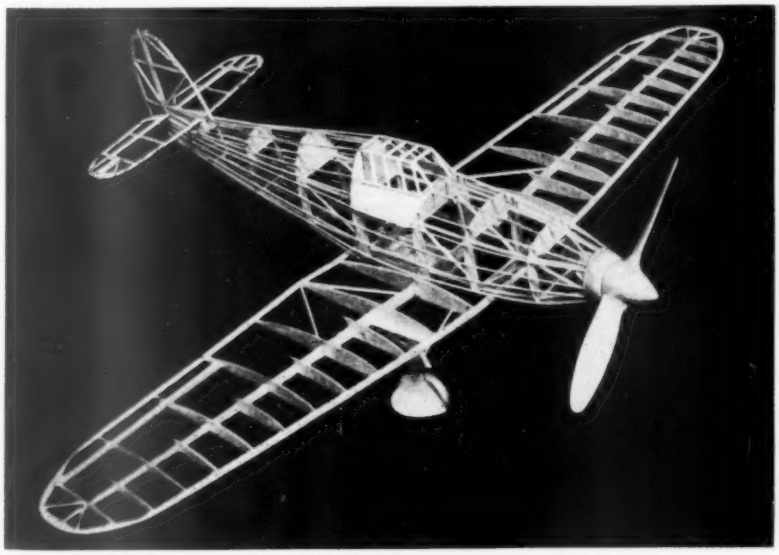
After all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator and such to a flat surface to keep from warping.

Apply Master Metal Unifoil over front part of tissue covered model.

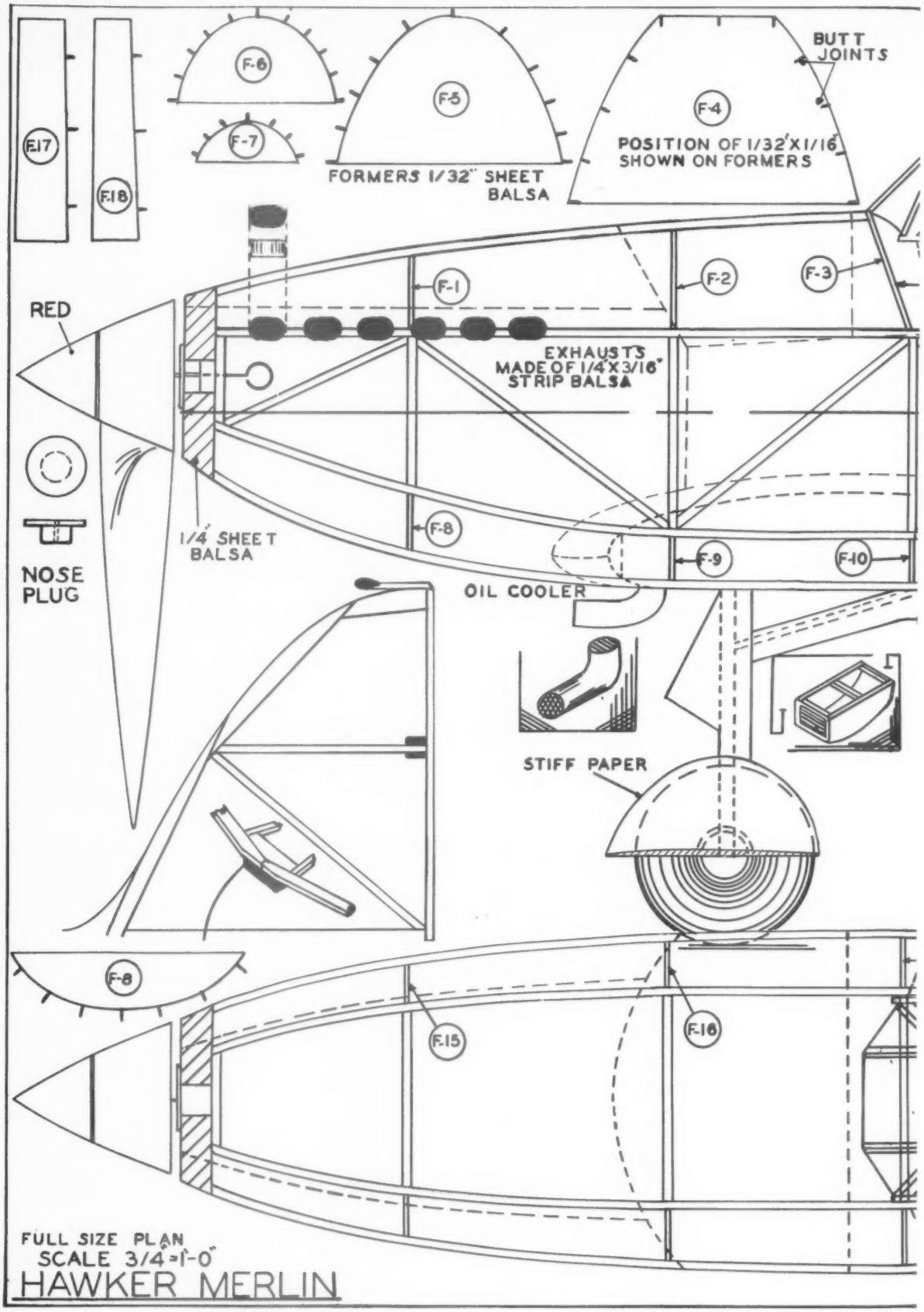
ASSEMBLY

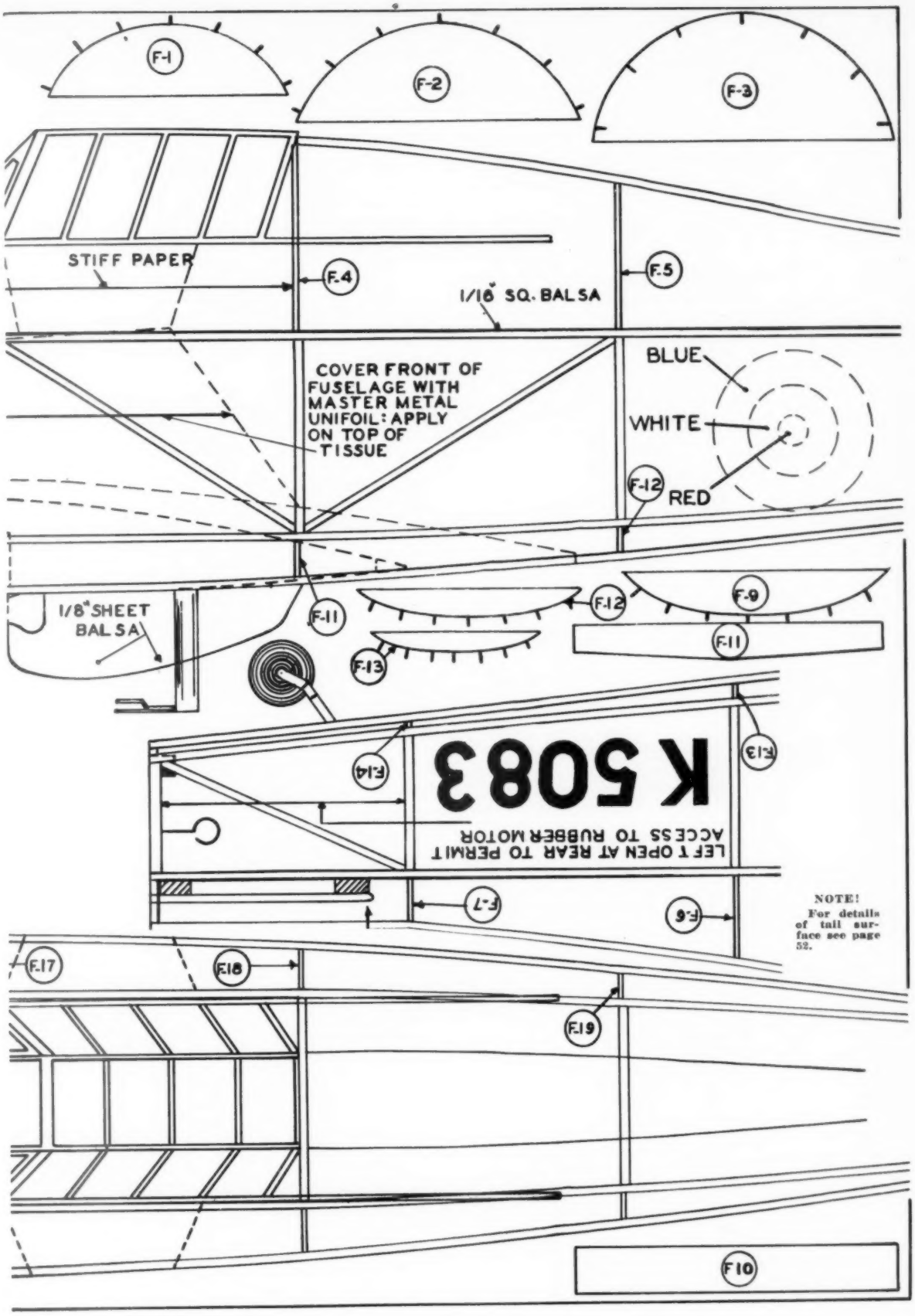
After the various parts have been com-

(*Concluded on page* 52)

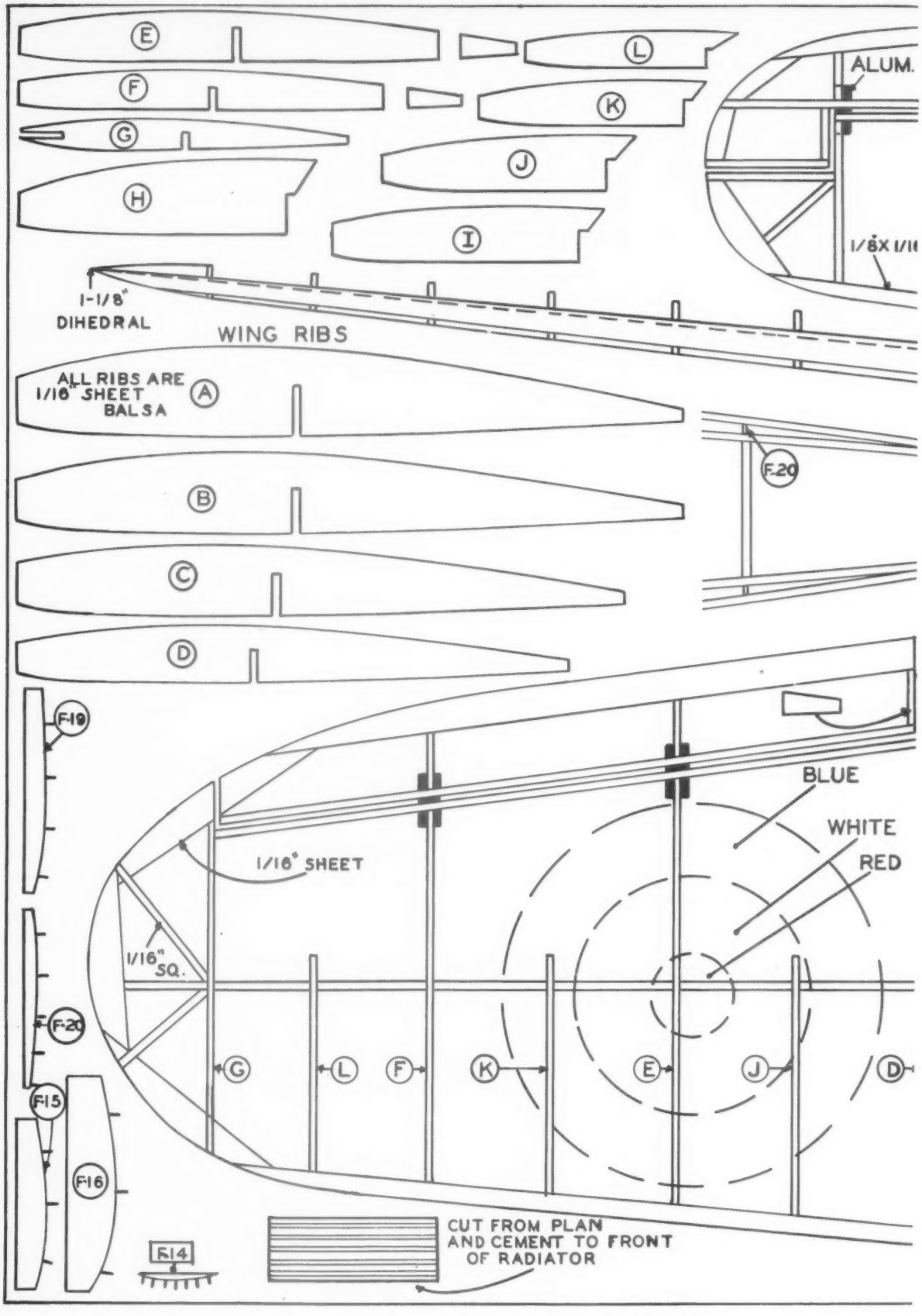


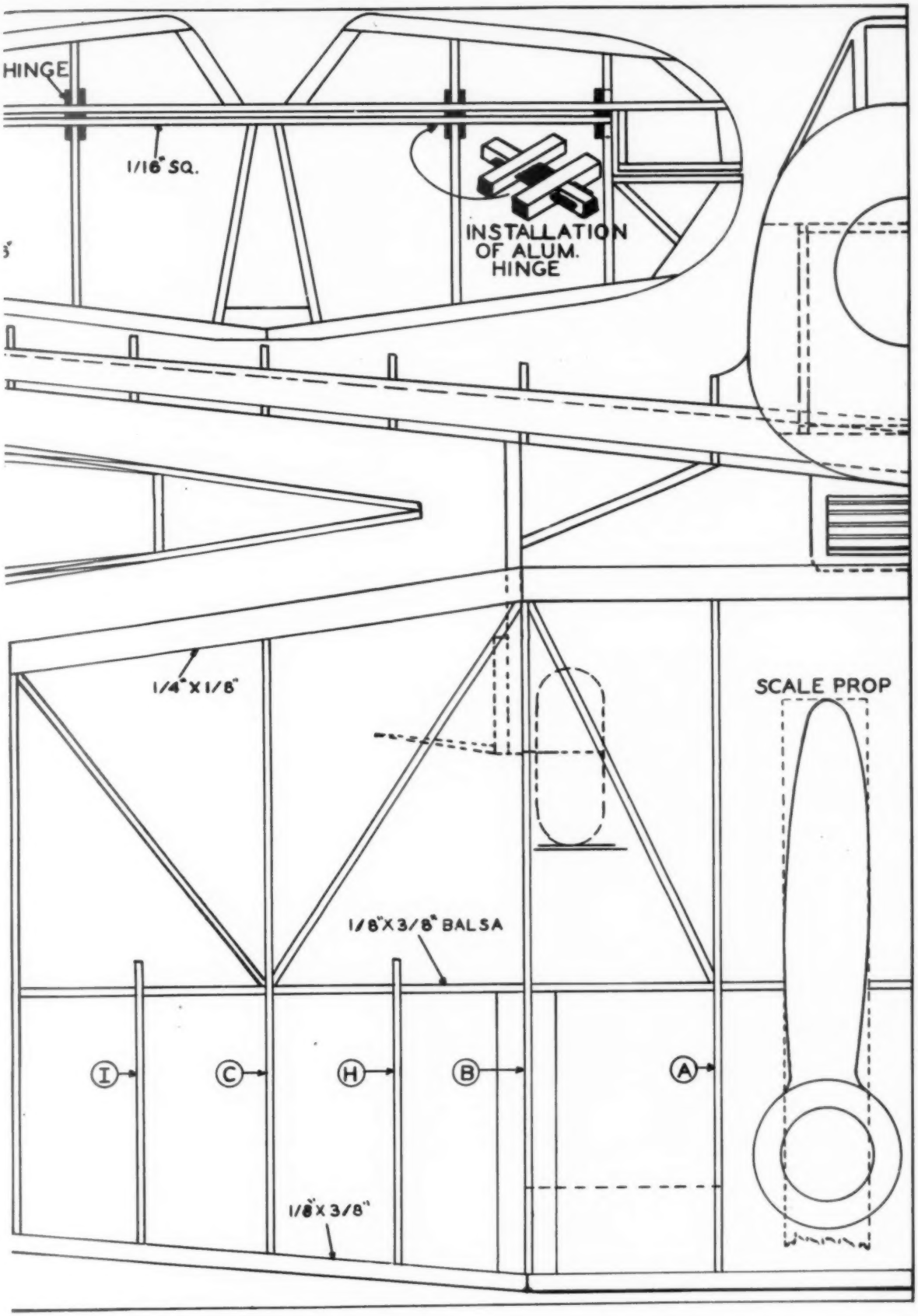
Here is the completed framework of the Hawker Merlin, a photo which should be used in connection with the drawings on the following pages.


F-17
F-18
F-6
F-7
F-5
FORMERS 1/32" SHEET BALSA
F-4
BUTT JOINTS
POSITION OF 1/32"X1/16" SHOWN ON FORMERS
F-1
F-2
F-3
RED
EXHAUSTS MADE OF 1/4"X3/16" STRIP BALSA
NOSE PLUG
1/4" SHEET BALSA
F-8
F-9
F-10
OIL COOLER
STIFF PAPER
F-8
F-15
F-16
FULL SIZE PLAN
SCALE 3/4"=1'-0"
HAWKER MERLIN



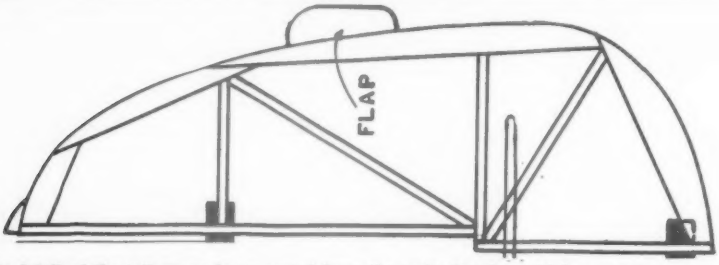
NOTE!
For details of tail surface see page 52.


E
F
G
H
I
J
K
L
ALUM.
1/8X 1/1
1-1/8"
DIHEDRAL
WING RIBS
ALL RIBS ARE
1/16" SHEET
BALSA
A
B
C
D
F-20
F-19
F-20
F-15
F-16
F-14
1/16" SHEET
1/16" SQ.
BLUE
WHITE
RED
G
L
F
K
E
J
D
CUT FROM PLAN
AND CEMENT TO FRONT
OF RADIATOR


HINGE
1/16" SQ.
INSTALLATION OF ALUM. HINGE
1/4" X 1/8"
SCALE PROP
1/8" X 3/8" BALSA
I
C
H
B
A
1/8" X 3/8"

Building the Hawker Merlin

(Continued from page 47)



This detail of the tail group is separated from the main drawing which appears on page 51.

pleted, cement them to their proper locations. All details, such as rivets, numerals, etc., are drawn on completed model with pen and ink. It is very important that you spend a little extra time with details, for all details make an attractive model.

TESTING AND FLYING

Two types of propellers are used on this model. One, which has a wide blade, is made of fiber. This type of blade causes the motor to turn at less r.p.m. and greater flights result. By twisting the blades the pitch can easily be adjusted.

The balsa scale propeller is used for exhibition purposes only. Six strands of one-eighth flat rubber are sufficient to fly the model. With the rubber motor and flying propeller in place, gently launch your model over tall grass. By this method, you can see if your model is properly balanced.

It should be borne in mind that all of the adjustable control surfaces such as the ailerons, elevators and rudders must be in proper alignment for flight. If the rear edge of the elevator is depressed, then there will be a tendency toward diving while the reverse action will be true with an upward curve of the elevator.

The ailerons are used principally for overcoming the torque of the rubber motor, depressing on aileron slightly will cause that end of the wing to rise, but this will also lead to some adjustment of the vertical rudder.

FOR BUSINESS OR PLEASURE • Travelers gather at The Stevens assured of gracious hospitalities and superlative service because its management cares.

THE STEVENS

ROOMS WITH BATH FROM $2.50

WORLD'S LARGEST HOTE

CHICAGO

OTTO K. EITEL GEN. MANAGER

Taylorcraft Now at Alliance, Ohio

MR. C. G. TAYLOR, who has completed the experimental and preliminary work on his new product the TAYLORCRAFT, has moved his headquarters to a well equipped airplane factory at Alliance, Ohio.

The Chamber of Commerce of Alliance, Ohio, through Mr. Geo. O'Brien, President, has negotiated for several months to have Mr. Taylor and his associates move their rapidly growing factory to Alliance. Through their efforts, The Taylorcraft Aviation Company have culminated arrangements for leasing the whole property of the former Argo Airplane Company's factory, equipment, and private airport situated one mile northeast of Alliance.

The factory is modern and well designed for aircraft manufacture. It is 60 feet by 300 feet. There are also several smaller buildings for doping, etc. The equipment consists of a very complete line of metal working and woodworking machinery, as well as a complete list of office and engineering equipment.

The airport consists of a well drained field with a natural high center and sloping with a gentle grade to the sides. It is nearly square and contains 137 acres of well developed sod. The runways are now in good condition.

Mr. C. G. Taylor organized and served as President and General Manager of the Taylor Aircraft Company of Bradford, Pennsylvania, for over five years. Last January he sold his interests in that concern and has produced the new plane called Taylorcraft: a two-place, side-by-side plane of very clean design. It is powered with a Continental motor and is made to sell for $1495.00. This is a type of plane that the Department of Commerce has been vitally interested in seeing developed so that flying may become more common among the general public.

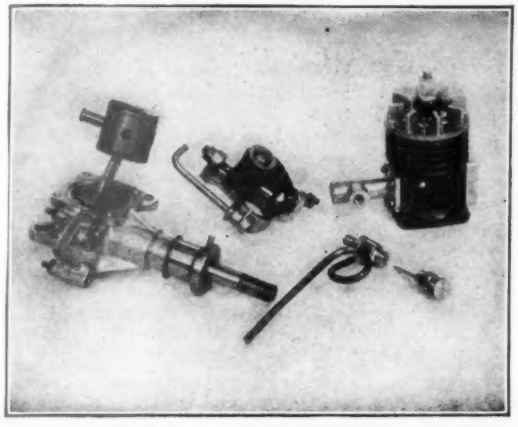
Associated with Mr. C. G. Taylor are a number of men who have helped make the low-priced, easy-to-fly lightplane possible. Mr. K. W. Tibbits is Production Manager for TAYLORCRAFT. He has been active in lightplane production for seven years and held a similar position previously. Mr. L. W. Salchow is in charge of the most important work in aircraft construction and, that is, the welding. He has had a number of years of experience in this art and has managed the welding production of lightplanes. Each of the major departments is being supervised by experienced and well-trained men.

The jigs, equipment, planes, and parts in process have recently been moved from Butler, Pennsylvania, to Alliance, Ohio. The production of Taylorcraft is now going forward at a greatly increased rate.

Private owners of lightplanes will welcome news of the activities at this plant which will be published from time to time in P. A.

G.H.Q. GAS ENGINES

AN ENGINEERING TRIUMPH . . . *never before at so low a price!*



Indeed an engineering triumph—accomplished by outstanding G. H. Q. designers and engineers, who have constructed into the G.H.Q. motor everything that years of exhaustive scientific aerodynamic research could produce—geared to the highest possible degree of perfection. But more than that, the acid test . . . an overwhelming response. Thousands of letters are pouring in from all parts of the country praising, recommending, and endorsing this scientific achievement. It seems as if everyone in America wants one. The most hair-raising thrill you've ever experienced will be yours with the G. H. Q. motor—actually one of the most powerful motors ever constructed. Has broken records for amazing performance . . . and just imagine—flies model planes up to 10 ft. wingspread. Also used for boats and stationary use. Easy to start and simple as ABC to assemble—average assembly time is only 45 minutes. So easy only a screwdriver is needed.

Everything is in the kit including plug, coil, condenser, tank, ignition wire, cylinder, piston, connecting rod, timer, crankshaft, all screws, nuts, bolts, etc. Every part is fully machined and finished. No oil, gas, batteries, or propeller included.

Postpaid for only..... **$8.50**

AND THESE FEATURES MAKE THE G. H. Q. GAS MOTOR A WINNER!

1. Easy starting—just a twist of the wrist.
2. Steady running—as long as gas, oil and spark are supplied.
3. Motor cannot overheat.
4. All parts replaceable.
5. Cylinder and piston lapped to within .0003.
6. Accurate die castings.
7. Crank shaft balanced and perfectly machined.
8. A light spark coil that is oil, water and gas proof.
9. Coil will not overheat or shortcircuit.
10. Main bearing is high-speed bronze, ground and lapped to size.
11. Condenser is gas, oil and water proof.
12. Cylinder and piston inspected cast iron to insure long life.
13. Chrome nickel steel shaft with 1⅛" bearing surface.
14. Connecting rod of high speed bronze.
15. Carburetor assembly accurately designed and made.
16. Needle valve and valve body machined together.
17. Breaker assembly compact, fool-proof, long wearing, replaceable and adjustable.
18. Easily inverted and runs in either direction.
19. Propeller blank included with finished motor.
20. Motor starts and runs on 2-ounce battery.
21. Speed range 500 to 10,000 R.P.M.
22. Low gas consumption—runs 27 minutes on one ounce of gas.
23. Strongest miniature motor.
24. LOWEST PRICE EVER SET.

AN APOLOGY—

Owing to the overwhelming response and rush of orders for G. H. Q. Gas Motors we were unable to maintain our 1 day delivery service. Orders sent now, however, will be filled in a few days.

GAS MOTOR ACCESSORIES

Spark Coil (Non-overheating)	$1.50
Spark Plug (24—⅜")	.75
Condenser	.10
Wheel Hubs (⅛" I. D.) per pair	.50
Propeller	1.50
Flywheel	1.50
Battery (special 2 oz. 4½ V.)	.50
Gas Tank (1 oz. streamlined)	.50
Midget Switches	.35
Propeller Blanks 14" diameter, 8" Pitch.	.25
Engine Instruction and Assembly Booklet	.10
Bamboo Paper.....2 sheets for	.15
Silk (special for gas jobs).....sq. yd.	.45

A Guarantee

G. H. Q. machinists have successfully constructed hundreds of finished motors from the kits without having had any motors which did not operate satisfactorily. Should any purchaser be unable to assemble a working motor he may return parts to us with $4.50 (charge for assembling and postage) plus cost of any damaged and missing part. Finished motor will be shipped in a few days.

Send 3c for illustrated catalog of gasoline motors, gasoline planes, gasoline accessories and parts

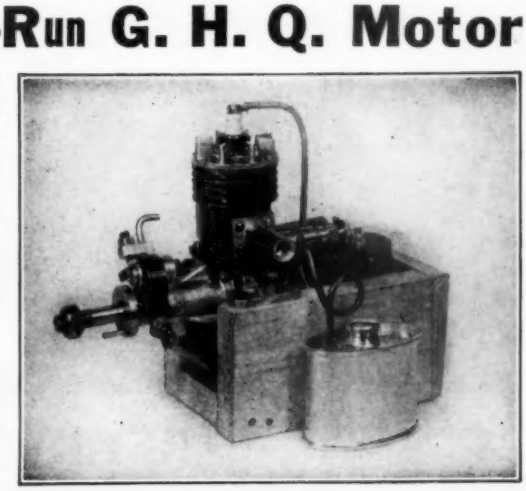
We have a complete line of kits from

10c to $1.00

Ready-to-Run G. H. Q. Motor

The famous motor complete, entirely assembled on stand. Tested and run before shipment—Performance guaranteed—1/5 horsepower at 3000 to 7000 R.P.M. —No oil, gas or batteries included. Postpaid for only

$12.50



FREE

1 finished fly wheel mounted on motor with every finished motor. This offer not for dealers.

HERE IS NEWEST G. H. Q. SENSATION!

G. H. Q. Sportster kit specially designed for G. H. Q. Gasoline motor but may be used for any other motor of like weight and power. Built according to scientific aerodynamic principles—Has made hundreds of successful flights without crackup—Marvelous glider . . . And what a climber, 4 hour flights are common! A complete kit of all parts including plan, all wood, wire, wheels, metal and other parts. Postpaid for only

$5.00

G. H. Q. MODEL AIRPLANE CO., 564P Southern Boulevard, New York, N. Y.

Air Board

(*Continued from page 30*)

courses in English. It misses a great deal. In one of Dickens' immortal novels a man who really had invented something thoroughly worth while, of definite value to the Government, was balked by the Government Circumlocution Office.

He was given the run-round and grew to embittered middle age until he received recognition and support from other sources. Mr. Wilford thought that something of the kind, though to a much lesser degree, existed in the relations between those seeking to further aviation developments and various governmental bodies. The Bureau of Aeronautics and Wright Field were both admirably equipped to handle production problems and new designs which were refinements of existing designs. He was not quite so sure that they were equally well prepared to consider and foster radically new developments, however potentially valuable.

He threw out a suggestion that both in the Bureau of Aeronautics and in the Army Air Corps there should be an officer or a group of officers concerned mainly with new developments, with ample time to consider them and, when valuable, ample authority to see them through.

It might take five to ten years for a valuable aeronautic idea to be reduced to practice. Could not some plan be evolved whereby the lag between inception and service use be shortened?

BLERIOT AND OVINGTON

It is sad to think that in the same month the world has lost two fine aviators: Louis Bleriot, the first man to fly the English Channel, and Earl Ovington, who used and built the first Bleriot models on Long Island as far back as 1911. Since papers and magazines have revived our memories of both these men, what the Air Board said about them is of little interest.

FLIVVER AIRPLANES

A member brought with him a newspaper clipping headed: "Tests Reveal Air Flivver at Low Price Nearer. Six Types of Experimental Machines Used in Inquiry for Commerce Bureau."

Granted that the development work of the Air Commerce Bureau is of real value, there still remains nothing more annoying than this constant reference by the press to the production of a flivver airplane under the auspices of the Air Commerce Bureau, when the true situation is as follows:

After two years of development work and considerable expenditure of the public's money there is no "development" plane which is really on the market. Not one of these planes is available for purchase under at least three thousand dollars, and one of the most successful of the six types is only purchasable at some seventy-eight hundred dollars.

In the meantime there are at least four manufacturers who without an iota of governmental support are producing fine two-seater airplanes under $1,500 sales price, and one company has sold 280 splendid two-seater models this year at $1,475.

The Government has itself given its airworthiness license to these serviceable, truly fine "flivver" airplanes. Therefore, it cannot very well say that the only safe planes are its own "special six," and that the low priced planes actually on the market, flying all over the country under varying conditions of weather and terrain are not safe.

In some respects the situation calls for honest and well founded indignation. In none of its proceedings to date did the Air Board show so much intensity and unanimity of feeling.

There was drafted the following definite and pointed recommendation:

"That the flivver or more properly low priced airplane is here already on the market. That these airplanes having been licensed by the Air Commerce Bureau and rendering fine service all over the country are certainly as safe, if not more so, than the six experimental types still in process of evolution.

"That the constant mention by the press that safe flivver airplanes are in the offing, gives an entirely erroneous impression to the public, and does great damage to the manufacturers of private aircraft. That the daily press and press associations who render such fine service to American aviation, always, should take cognizance of these facts and modify their policies accordingly."

END.

THE LAST WORD IN GAS MODELS

★

Span OVER 6 FT.
Length OVER 3½ FT.

The **REARWIN** *Speedster*

Sensational Performance

Flies 20 M.P.H. Over 30 minutes on ½ oz. gas (capacity 1 oz.). Takes off in 25 feet. Lands at 16 M.P.H. Full Size Plans.

Full size plans, ready cut out ribs, Latest Type M. & M. air wheels, aluminum motor mount, sheet aluminum for cowling, special metal fittings, veneer, all balsa parts cut to correct size, tubing, rods, springs for shock absorbing landing gear and clear and colored dopes. This fine kit is complete down to special bolts, screws and many other parts too numerous to mention here. HIGH QUALITY and REAL VALUE.
COMPLETE KIT only $7.00.
COMPLETE KIT INCLUDING BABY CYCLONE MOTOR $22.75
Add 50c extra to cover cost of packing and mailing.
(West of Mississippi add 10%; Canada, 10%; Foreign, 15%.)

Note:

The Baby Cyclone or any light model engine can be installed in this Rearwin Model.

Send Orders to

AVIATION PRODUCTS CO.

619 S. Federal St. CHICAGO, ILL.

French Notes

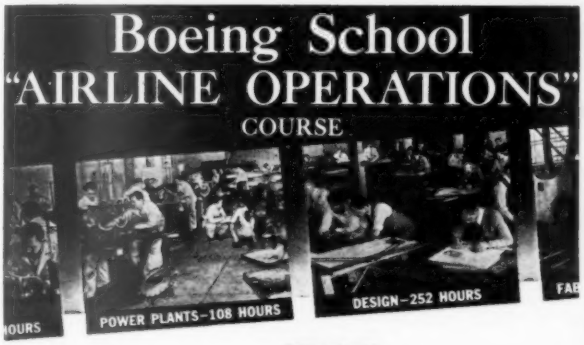
(*Continued from page 30*)

ing. This record, of 45 years continuous service, is rather an amazing fact to consider for those who are accustomed to think of aviation as a *new* industry. And it is undoubtedly the reason France is one of the most air-minded nations in the world today.

The Aero-Club is housed in an imposing old mansion at 6 rue Galilee, near the Arch de Triomphe. The two upper floors are occupied by the business offices and archives of the organization, and on the street level floor, the Tourisme de France maintain an office which can furnish information concerning air-travel, either private or commercial, in any part of the world.

The trophies, that have been awarded for record flights, races and scientific developments, are of all sizes and shapes; some are made of silver, others of bronze, marble, crystal and gold. It is interesting to contrast the massive marble model of a dirigible, which was the Gordon Bennett Cup trophy for 1906, with the modernistic design in silver . . . representing the front view of the trim, slender lines of a racing ship, the whirling gleam of the propeller aptly suggested by a cloudy bit of crystal . . . which is the Grand Prix de Aero-Club for 1935-36. The two trophies seem to represent, not only thirty years difference in art designs, but to visualize the difference between these first clumsy aircraft and the graceful beauty of the modern planes.

END.



3372 *Hours*

of Theory and Practice

Boeing School's 24-month "Airline Operations" course offers a thorough preparation for communications, metals, instruments, engines, electrical, sales, and administrative work . . . a sound background for such jobs as assisstant field manager, field clerk, traffic man.

At Boeing School, instruction is based directly on the actual practice of United Air Lines with its 100 million miles of experience.

Moreover, as a division of United, Boeing School is in a key position to prepare you for the *coming developments* in construction and maintenance.

And at *this school* you get more hours of personal instruction. Boeing School's staff includes more licensed ground instructors than any other air school in the country.

Outstanding, too, are the laboratories and 7 shops you work in: Engines, Woodworking, Welding & Metals, Fabrication & Design, Radio, Instruments, Maintenance.

Five ground courses: 12-week "Aircraft Sheet Metal"; 9-month "Airline Dispatching and Meteorology"; 9-month "Airline Technician"; 12-month "Airline Mechanics"—and the 24-month "Airline Operations" course, the most complete ground training offered by Boeing School. This course gives you a thorough grasp of a wide range of subjects in Aerodynamics, Design, Meteorography, Power Plants, Instruments, Fabrications, Metallurgy, Materials, Communications, and Airline Operations.

Send for 1936 Bulletin

There's a Boeing School course to prepare you for any field of aeronautics. The *Bulletin* describes ground and air courses, gives costs and enrollment requirements. Mail coupon below for your copy today.

SEVEN PILOT COURSES

Boeing School Pilot courses are outstanding. The 2-year "Airline Pilot and Operations" course is considered the most complete in America. Send coupon for details.

Next regular enrollment September 28

BOEING SCHOOL OF AERONAUTICS — A division of UNITED AIR LINES

Department Q-10, Airport, Oakland, California.
Gentlemen: Without obligation, send me the 1936 Boeing School Bulletin, giving complete information on courses indicated:

- ☐ Airline Pilot and Operations
- ☐ Private or Amateur Pilot
- ☐ Transport Pilot
- ☐ Limited Comm'l Pilot
- ☐ Airline Pilot
- ☐ Airline Mechanic
- ☐ Airline Operations
- ☐ Aircraft Sheet Metal
- ☐ Airline Technician (For engineering graduates only)
- ☐ Airline Dispatching and Meteorology (2 years college required)
- ☐ Special Airline Pilot (For Transport Pilots only)
- ☐ Home Study Courses (For those engaged in the industry)

Name _____ Age _____
Years in High School _____ Years in College _____
Address _____ Phone _____
City _____ State _____

BOEING SCHOOL'S 12-Month "AIRLINE MECHANIC" course covers 39 SUBJECTS

This basic course prepares you for many types of jobs at airports, factories and on the lines

You get a *greater breadth of experience* at Boeing School.

Back of this school stands United Air Lines—with its 100,000,000 *miles of air transport experience.* And in United's adjoining shops you can watch the practical application of your training.

Your instructors are specialists with from 10 to 24 years of experience in the industry. And they are able to give you *more hours of individual attention.* (Boeing School's staff includes more licensed ground instructors than any other air school in the country.)

In the "Airline Mechanic"—one of 5 ground courses—you cover *theory* in classrooms and laboratories; practical work in 7 modern shops: Radio, Maintenance, Power Plants, Woodworking, Welding & Metals, Fabrication & Design, and Instruments. You become familiar with industry practice through actual hangar service at Boeing School.

Write today for School Bulletin

The 1936 Boeing School Bulletin describes ground and air courses. Outlines costs and enrollment requirements.

Put the coupon below in the mail today.

SEVEN PILOT COURSES

Boeing School Pilot courses are outstanding. The 2-year "Airline Pilot and Operations" course is considered the most complete in America. Send coupon for details.

Next regular enrollment September 28

BOEING SCHOOL OF AERONAUTICS — A division of UNITED AIR LINES

Department Q-10, Airport, Oakland, California
Gentlemen: Without obligation, send me the 1936 Boeing School Bulletin, giving full information on courses indicated:

- ☐ Airline Pilot and Operations
- ☐ Private or Amateur Pilot
- ☐ Transport Pilot
- ☐ Limited Comm'l Pilot
- ☐ Airline Pilot
- ☐ Airline Mechanic
- ☐ Airline Operations
- ☐ Airline Technician (For engineering graduates only)
- ☐ Airline Dispatching and Meteorology (2 years college required)
- ☐ Special Airline Pilot (For Transport Pilots only)
- ☐ Home Study Courses (For those in the industry)
- ☐ Aircraft Sheet Metal

Name _____ Age _____
Years in High School _____ Years in College _____
Address _____ Phone _____
City _____ State _____

BUFFALO PUBLIC LIBRARY DEPARTMENT OF TECHNOLOGY

Hammond Plane

(*Continued from page* 16)

ship for the Bureau previous to the present "Y" but it had been sent back because its performance did not meet requirements.

Mr. Geisse climbed in and motioned me in beside him. The cabin differed from an ordinary airplane only in that it had surprisingly fine visibility. I hooked the safety belt carefully, prepared for the worst.

Taxying out on the airport Mr. Geisse pointed out that the rudder had been locked in neutral; the pedals operated the brakes only, therefore were used only on takeoffs and landings. As we sped down the runway with the ship's flaps down, Mr. Geisse counteracted a cross wind with slight touches of opposite brake. When the airspeed indicator pointed to 60 we were climbing steeply. At 1,000 feet Geisse leveled off and pulled back on the lever between our seats. The flaps came up and we darted forward in full flight.

In a few seconds came the signal I'd come all the way to Washington for. I took the controls. Thinking I was faced with the pitfalls of coordination and sensitivity that accompanies the conventional airplane, I was afraid to move the control stick. But when Geisse signaled me to the left I prayed and pushed. Instead of a side slip the Hammond eased into a perfectly normal bank.

The mercury bubble in the turn and bank indicator stayed between the two hairlines. No rudder; the stick was all that did it. My confidence picked up. I pushed the stick to the right. Another perfect bank. I climbed to 1,500 feet and tried a stall. No falling off on a wing. Just a forward mush to pick up speed again. It was just too easy to believe.

But the proof of an airplane is in the landing. I headed in fearfully. Off the east end of the airport I cut the gun. Geisse moved for the first time since I'd taken the controls. He lowered the flaps. No matter how hard I held the nose down the flaps held the ship's speed down to 70. It worked that way with engine wide open or idling.

Near the ground I pulled back in fear but Geisse told me to go on down. I pushed forward. Just before we hit I eased back a little and the wheels rolled gently as the ship settled on its extraordinarily strong shock absorbers. Geisse slammed on the brakes as soon as the wheels touched and we stopped within inches.

I was dumbfounded. *I had actually landed that airplane—and with no instruction or apparent danger!* But I didn't even believe myself. I headed back down the runway, took off, climbed, pulled up the flaps and flew around looking over the city as though I were a veteran pilot. Army and navy planes flew past waggling their wings at our funny looking contraption. I headed back for another landing.

Geisse just watched as I lowered the flaps, cut the gun and settled slowly. This time, however, I didn't level off at all and, quite unintentionally, literally hit the ground in a shallow dive. Thump! The ship didn't bounce an inch; I slammed hard on the brake pedals as I'd seen Geisse do and we screeched to a stop.

By that time I was wondering who could possibly have ignored this development without having some quite disturbing qualms. Experienced, veteran airmen who had flown the ship at Washington previous to my visit had nodded slight approval but their general consensus of preference was that they'd rather fly something that drew every bit of skill at their command. Therefore the new ship was "all right" but something a little hotter and snappier would be preferred.

Yet, here was a ship far easier to take off, fly and land than an automobile was to drive! Though it was an experimental airplane, I actually had flown it from take off to landing with absolutely no instruction!

What does the fact that I flew the Hammond "Y" mean? First, if I can fly the ship why in heaven's name can't the thousands of other Americans who would gladly pay cash for one of them today? And, if those average fellows can fly the ship doesn't that mean that the present-day private airplane has been decidedly improved upon? I don't see how anyone, prejudiced as they may be, can deny that. Incidentally, not one of the loudest Bureau critics ever has tried to fly the Hammond although the ship's available to the entire aviation industry to inspect.

Second, that somewhere lurks a group of professional back-biters who surely will turn on me once this appears in print. From then on I'll probably be termed something on the order of "crackpot Bureau of Air Commerce press agent". Let 'em rave. Whatever they say, though, they can't deny that I flew that ship.

If these photographs aren't proof enough, there are plenty of persons in Washington who will verify it. And it's easily proved that I'm not a pilot of any sort.

The possibilities offered by this quietly developed experimental airplane present a serious problem for the future that will have to be dealt with carefully and thoroughly. With the already-known numbers of persons wanting to own and operate ships based on this Bureau of Air Commerce experiment the Bureau will have to draw up and enforce licensing and operating regulations stricter even than those in existence today.

The Hammond, strictly an aeronautical guinea pig, is not on the market at present and can't be purchased. The ship merely is part of the Bureau's development program as is the Waterman, Weick, Curtiss-Wright Coupe, Arrow Arrowplane and the roadable Autogiro. Each of these ships was contracted for with some specific improvement or development in mind.

The Waterman, for instance, is a tailless airplane and was purchased for one major advantage—simplicity of construction and compactness. The Weick, like the Hammond, was purchased for flight characteristics and experiments

ROOSEVELT FIELD

"World's Premier Airport"

MINEOLA, LONG ISLAND
NEW YORK

From New York 35 Minutes by Rail, 45 Minutes by Car

SACRIFICE SALE
Certified Licensed Used Airplanes

Waco Custom, 1935; 285 Wright, controllable propeller, radio, special paint, many other extras.
Waco Custom Cabin Demonstrator; 250 Wright, fully equipped for blind flying including hood.
Waco 1933 Cabin; landing lights, flares, steel propeller; motor just majored.
Many others including Waco F-2, F-3, Eaglerock, Stinson, Privateers, at reasonably low prices.
Trade or terms to responsible parties.
Used aircraft radios for sale

WACO SALES
OF NEW YORK, INC.
HANGAR 16, Roosevelt Field, Mineola, N. Y.
N. Y. Phone: Vigilant 4-5317 Field: Garden City, 5313

ENGINE BROKERS CO.
Widest Variety of
Engines and Parts
IN STOCK
Hangar B Garden City 8998

"LEARN TO FLY"
NEW YORK HOME
OF
TAYLOR CUB
CUB SALES OF N. Y.
HANGAR 55
Allen M. Hull Garden City 9659

DOUGLAS-WARD AIRCRAFT CORP.
ROOSEVELT FIELD
BEECHCRAFT AGENCY
Used Planes Aerial Photography
Charter Service
HANGAR C GARDEN CITY: 6876

Hangar 7 Garden City 0096
PLANE OWNERS SERVICE, INC.
AIRCRAFT
REFINISHES—OVERHAULS—
REPAIRS

with simplified controls. The Curtiss-Wright Coupe represents the search for an inexpensive, easy-to-maintain all-metal construction identical to that used on modern airliners. The roadable Autogiro is another example of the Bureau's search for new, safer flight characteristics as well as ease and safety in handling on the ground.

The Arrow is just an airplane behind what is more important to the development project—the converted Ford V8 automobile engine. This and several other auto engines are being tested exhaustively for adaptation to flying. While the average 90-h.p. aircraft engine costs approximately $1,000 a complete auto engine of the same power can be purchased for less than $200.

All these eventually are expected to be combined into the standard, economical, safe private airplane of the future—a low-winged all-metal cabin monoplane with comfortable accommodations for two persons and extremely airworthy and safe inherently under almost any conceivable circumstance. *There is no reason why the price shouldn't equal that of a popular priced automobile of today.*

All scandalmongers to the contrary, each of the above projects is in the hands of private companies at present and all future production will be by private companies.

Perhaps, some day, today's criticasters will apologize for the wrong they've done aviation. But, judging by past performances, I'm afraid they'll go on worshipping themselves among themselves and writing about themselves in their own publications.

They're the type.

EDITOR'S NOTE We have been convinced, admittedly somewhat against our will, that this lightplane program has been far more successful than rumor would have it, so we'll pull in our neck in honor of the great discovery.

Japanese Planes

(*Continued from page* 19)

fighter and in 1932 Kawasaki built an all metal fighter, both of which were adopted by our Army and, with necessary improvements, better performances are now available. These two types have a speed of over 300 km. per hour with climbing speed of 3,000 meters in 4 minutes. They can do any kind of acrobatic flights.

Much was learned in China by the members of our air force and the proper corrective measures are being taken. It is well, we believe, that we followed the program outlined here in respect to testing out foreign built planes and engine, gaining the best of each.

SPECIFICATIONS OF JAPANESE ARMY FIGHTERS

Name	A 3	C 1	A 4	91	92
Machine Type	Nieuport 24. C 1	Spad 13	Nieuport 29. C 1	Nakajima 1931	Kawasaki 1932
Year	1919-25	1919-22	1923-30	1931-	1932-
Span (m)	8.22	8	9.7	11	10
Length (m)	5.67	6.3	6.5	7	7
Height (m)	2.3	2.3	2.5	3	3
Wing area (sq. m)	15	20.2	27	20	24
Wt. empty (kgs.)	450	575	825	..	..
Load (kgs.)	180	225	235	..	..
Total wt. (kgs.)	630	820	1060	1500	1700
Speed (km.p.h.)	170	215	235	300	330
Climbing to 3000 m. (minutes)	12	9	8	4	4
Motor	L'Rhone	Hispano	Hispano	Jupitor	Kawasaki-B.M.W.
H.P.	120	220	300	450	500/600
M.gun	1	1-2	2	2	2
Ceiling (m)	6000	7000	8500	9000	8500

CHICAGO AREA

You Meet All the Pilots at the
AVIATION GRILL
IN THE ADMINISTRATION BUILDING
6.00 S. CICERO AVE., CHICAGO, ILL.
COMPLETE LINE OF AVIATION SOUVENIRS
FOOD BEVERAGES REFRESHMENTS
TELEPHONE—PROSPECT 10261

BUSH SALES & SERVICE
Distributors
WACO AIRPLANES
PORTERFIELD
Standard Oil Hangar — Chicago Municipal Airport
5214 W. 63rd Street
Phone: Republic 5990—Night: Beverly 5687

Fly The Plane You Can Buy
REARWIN
Sales - Service - Instruction
General Air Service
4500 W. 83rd St.
B. G. DeWitt Prospect 0151

FLOYD BENNETT FIELD
"New York's Air Pride"
MUNICIPAL AIRPORT No. 1
BROOKLYN, NEW YORK
Phone: Nightingale 4-3600

HOLD EVERYTHING!
If You Expect to Learn to Fly, Visit the A. E. Club Rooms and Library in the Administration Bldg.
Send 3c for American Escadrille Monthly Bulletin—or 50c for Membership and Cadet Flight Brochures
AMERICAN ESCADRILLE
Composed of America's Present and Future Air Pilots
FLOYD BENNETT AIRPORT, N. Y.
PHONE MIDWOOD 8-9760

AIRPLANES
Lockheed Air Express $3,000
Monocoupe D-145 2,500
Travel Air J-5 1,250
Kittyhawk (Kinner), 3-place 1,000
Curtiss Robin 850
HOEY AIR SERVICES
Hangar No. 3, Floyd Bennett Field, Brooklyn, N. Y.
Telephone: Nightingale 4-4200

PILOTS PREFER
PONTIACS AT
FLOYD BENNETT FIELD
BORO MOTORS
EASTERN PKWY. AT HOWARD AVE.
DICKENS 6-4120 BROOKLYN

The Flying School of Exceptional Quality
Brooklyn Flying Service
No. 6 Hangar Sampson Held, Mgr.
NIGHTINGALE 4-1415

THE HOME PORT
of
SKY ADVERTISING SERVICE
Sky Signs—Sky Writing—Illuminated Signs—Aerial Broadcasting—Goodyear Blimp Service, Day and Night
S. S. PIKE COMPANY
50 E. 42nd St. Hangar 6 Tel. Van 3-2431

WHILE ON THE TERRACE
YOU CAN EAT AND DRINK
WHILE ENJOYING THE FLYING
AVIATION BAR AND GRILL
IN THE SOUTH WING OF THE ADMINISTRATION BUILDING
BEER, 10c; COCKTAILS, 25c AND UP
FAMOUS FOR OUR 55c LUNCHEONS
COCKTAIL LOUNGE
NIGHTINGALE 42220

Airy Chat

(*Continued from page* 12)

seems human, but actually he is a mechanical man operated by a motor. The motor assists him in making perfect jumps, pulls the rip-cord and floats to earth with a trail of smoke behind him. We hope he never joins the Caterpillar Club.

* * *

BRANIFF AIRWAYS announce that fan-dancer Sally Rand will assist the crew in inaugurating the new Braniff service. But, even more interesting than the announcement is the naive line: "Sally Rand . . . without her fans . . . will wear a uniform of her own design." Now this is just what sticks us, for the last published account of Sally showed her adorned with hand-painted butterflies and dragons, or something of the sort. This should sure popularize the Braniff lines.

* * *

AND once more they come right back at us. This time we have a reply to the note by Huston West appearing in the last issue who desired to organize a "Quick Solo Club." The reply is by Dr. P. A. Mullikin, who believes that he is eligible for membership, as the instructor turned him loose three hours and twenty minutes from scratch.

He suggests that the name of the club be revised so as to read: "Quick Safe Solo Club." We hope to get some more entries and to hear the stories of the solo, providing the story does not run more than about 50 words. No, this is not a let down for that sad yarn, "My first solo." This solo will have to be inside five hours for eligibility.

* * *

V. E. THOMPSON, the "parachute man" of Aurora, Ill., sends us some interesting notes of the doings at the North Montana State Fair, Great Falls, same state. He tells particularly of the performance of George Moffatt, professionally known as "Diavolo, the Bat Man."

Diavolo, equipped with wings (not an angel's wings yet), jumped at over 10,000 feet and flapped his wings about for some time in imitation of bird flight. As he neared the ground, however, he was compelled to take to the good old reliable 'chute and made a spectacular landing in front of the grand stand. This, though an unbirdlike contact with mother earth, was at least more . . . sanitary.

And then came the thriller of thrills. F. F. Frakes and his plane crashing stunts that have been mentioned in P. A. Frakes crashed straight into a specially built house on the fair grounds, where the plane was reduced to a tangled mass of twisted tubing and shredded fabric. From within the wreck issued the redoubtable pilot, somewhat shaken but unharmed as usual.

* * *

WHICH brings about the fact that we received a mighty welcome visit from Mr. Frakes, who drove straight to Chicago after the Montana fair, a distance of 2,000 miles in two days. He sure is a glutton for punishment, this man Frakes.

But, best of all, he left some thrilling crash pictures with us from which we have already made the engravings. He promised to write us a story around these pictures and we'll keep after him until he fulfills his promise.

* * *

WE have received many interesting letters of late from our English readers, who number quite a few. There is a lot of aviation interest in England but, unfortunately, there are not many private flyers and practically zero home-builders according to their account. Too bad that they are in the same pickle that we're in over here, for the English lads are of the type who would make things hum once the lid was lifted.

* * *

JUST got a fine letter from "Speed" Westphal, who writes from California. He still is a glider enthusiast, although somewhat tied to earth by the various bonds of red tape and governmental restrictions.

* * *

ALL the old time ornithopterists are on deck with a thousand different ideas on the subject of ornithopters and wing flappers in general. Almost every feather on the bird has been carefully mapped out and, though they disagree in the main as to the functioning of the feathers, they still are positive that they know how the birds fly.

* * *

So long—J. B. R.

CURTISS SOC-1

. . . The New Scout-Observation Plane of the U. S. NAVY

The Curtiss Aeroplane and Motor Company has manufactured and delivered to the U. S. Navy 135 Scout-Observation Planes in less than 12 months. The Navy Department recently placed an additional order for 40 planes of this type—making a total of 175 SOC-1 planes ordered by the U. S. Navy, Bureau of Aeronautics during the past 15 months.

The total business involved on this order amounts to approximately $3,500,000. Nearly 70% of this amount went into productive labor—an important contribution to labor and business recovery.

The United States Army Air Corps recently purchased from Curtiss a squadron of Curtiss Y1A-18 Attack Planes—the first twin-engine Attack planes of the U. S. Army.

CURTISS AEROPLANE AND MOTOR COMPANY

Buffalo New York

A Division of Curtiss-Wright Corporation
"The Pioneers of Aviation"

FOR SALE! PLANE MANUFACTURING BUSINESS

Nationally Known Sport Planes

Three Models One With A. T. C. All three ready to fly and show

Drawings, patterns, jigs, tools, machines, 3 or 4 finished planes, raw material, good-will, a nationally advertised going concern with thousands of good inquiries in files as a result of past advertising and efforts. All at a reasonable price considering cost of engineering and development.
If you can handle such a manufacturing business and have a nominal capital to invest, write us for ILLUSTRATED AND DESCRIPTIVE CATALOG and other information.

Box 400 Popular Aviation, 608 So. Dearborn Chicago, Ill.

NEW CURTISS F11C4 NAVY PURSUIT

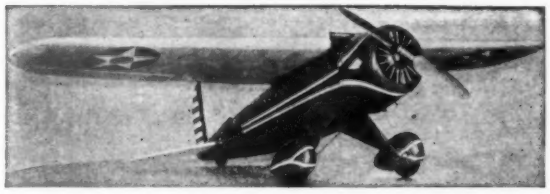
28" Span. Length 20½". Weight 4 oz. 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD

A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3⅜" celluloid, 1000 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.

Construction Set complete, postpaid..... $4.50

41" LOCKHEED ARMY SPEED VEGA



41" Span. Length 28". Weight 8 oz. 1" Scale

This new model, built very strong yet light in weight, is practically crashproof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 26' rubber, 3 oz. yellow dope, 2 oz. blue, ⅛ oz. black, 2 oz. glue, cement covering, full size scale drawing, and all parts.

Construction Set complete, postpaid..... $4.95

NEW BOEING P26A ARMY FIGHTER

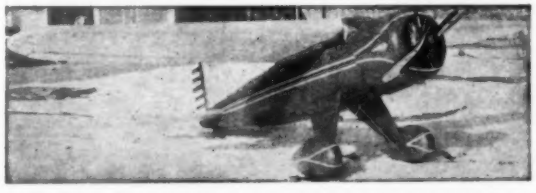
22" Span. Length 17½". Weight 2½ oz. ¾" Scale

Above photo shows finest equipped model of this plane on the market. Having ready made motor, cowl, prop, etc., it is very easy to build and is a beauty. Const. set contains 3" celluloid motor, 3¼" spun tapered aluminum cowl ring, 8" steel type paulownia wood prop, 1⅜" celluloid wheels, tail wheel, insignia, windshield, instrument board, 1 oz. yellow dope, 1 oz. blue, cement, glue, all parts printed on balsa, and drawing.

Construction Set in labeled box, postpaid..... $2.75

82" NEW LOCKHEED ARMY SPEED VEGA

Easy to Build—All Parts Ready Cut Out



82" Span. Length 54½". 2" Scale. Weight 5½ lbs. with motor.

World's finest equipped and most perfect scale gas model

This is an exact scale model of the latest Army Vega, beautifully streamlined. A special de luxe flying gas model with all formers, wing ribs, tips, wheel pants already cut out and notched. Turned balsa motor front, 4½" pneumatic air wheels, silk covering, army blue and yellow dope, glue, etc. Model has removable wing, and is especially designed for gas motor. It is very strong, practically crashproof—there being no exterior parts or struts to break. Takes off in 30 foot run, flies over 1 mile on ¾ oz. of gasoline.

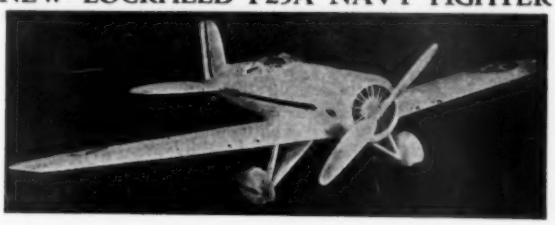
Construction Set complete without motor, postpaid..... $25.00

CATALOGUE—Send 3c stamp for 8"x10" beautifully illustrated Catalogue containing large photos of the world's finest scale models.

Above Gas Model Uses the BROWN, JR., Gas Motor

Note: In issuing money orders, use St. George, N. Y., postoffice

NEW LOCKHEED P23A NAVY FIGHTER



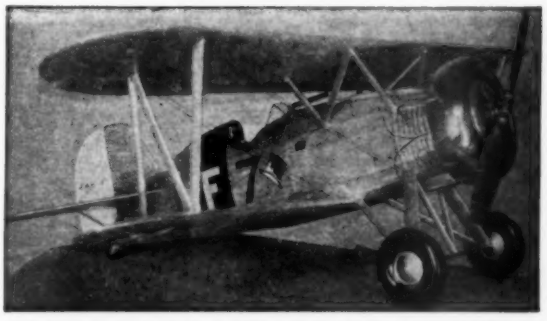
COMBINATION LAND AND SEA PLANE SET

32" Span. Length 20⅛". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅝" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1oz. cement, ½ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 feet of rubber, and large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world.

Construction Set in labeled gift box, postpaid..... $2.95

NEW BOEING F4B4 NAVY FIGHTER



22½" Span. Length 14½". Weight 2½ oz. Color, Silver and Yellow

This is the finest equipped Boeing, F4B4 model in the world.. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished propeller, printed out balsa wood parts, silver dope, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. Construction Set complete, postpaid..... $2.95

NEW NORTHROP FT1 NAVY FIGHTER

22" Span. Length 15". Weight 2½ oz. ¾" Scale

A beautiful flying model of the latest Northrop 280 m.p.h. fighter. Set contains 2" turned motor front, 8" carved propeller, insignia, silver, black and clear dope, glue, all parts printed on balsa, full scale drawing, and all parts to build as shown

Construction Set complete, postpaid..... $2.00

LOCKHEED R20-1 NAVY ATTACK

27½" Span. Weight 3½ oz. Color, Silver, Blue. ½" Scale

Model is fully detailed with authentic wing rib and body stringer spacing. Every air-minded boy will want this powerful-looking model. Motor power is run through the fuselage and is concealed—a special exclusive feature.

Set contains 2 standard steel type carved wood propellers, 16' rubber, star and rudder insignia, all parts printed on balsa, 2 turned balsa motor fronts, balsa air wheels, silver dope, black, glue, full size scale drawing, and all parts to build.

Construction Set complete, postpaid..... $2.95

California Dealer: JAYS MODEL AIRCRAFT, 7763 Melrose Ave., Hollywood, California

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

XUM

Bleriot

(*Continued from page* 18)

on the water to wait for help in case of emergencies or damage. The amphibian plane, too heavy and too difficult to handle, will have to be abandoned; the experiments made with them have not given any satisfactory results.

The heroic era in aviation is now closed, but that doesn't mean that there is no more progress to be realized. Almost daily, daring exploits are being linked up, one to the other. Enormous distances are being covered with machines almost as light as the one with which I crossed the Channel. Tomorrow they will be constructing machines that are as easy to handle as bicycles, or those air buses that Jules Verne dreamed of. The conquest of the air is ended as such and progress will now lie in the perfection of details on machines and in the popularization of the use of the routes of the air.

END.

Construction

(*Continued from page* 44)

order to have as little trouble as possible in balancing the ship. In the event that the light plane fan is truly interested in all phases of the business I should advise making a balance diagram. It is good experience and a lot can be learned in this way. From my own experience the greater part of the fellows who are building ships are just as much interested in learning as much as possible about construction as they are in just learning to fly.

The next step is to build the ship. So far we have only talked about getting ready to build but we haven't said anything about the actual construction. Possibly the first in the construction is the proper selection of tools. A hack saw is one of the first items for consideration. The average lightplane rarely uses tubing thicker than eighteen gauge. For this type of tubing the hack saw blades should have thirty-two teeth to the inch. For anything thicker than eighteen gauge, twenty-four teeth is sufficient, while for solid stock for fittings, etc., there should be blades of eighteen or twenty-four teeth. It is preferable that the hack saw itself should be a pistol grip saw with an opening sufficient to take a twelve inch blade. For use in conjunction with the hack saw there should be a complete set of files for any type of work. However, the builder can get along very well with an eight inch mill file. Then there should be a ball pein hammer, a complete set of wrenches, several sizes of screw drivers, several good cold chisels, a good emery wheel, diagonal cutting pliers, several plain pliers, tinners snips, and several clamps with a six inch opening. Other equipment for metal work which is highly desirable but not absolutely necessary, is a small lathe and a drill press. A hand drill and at least one good electric drill are also necessary. For work on the wooden portions of the structure, a drill, hammers, screw drivers, several saws, and several clamps are also necessary. A plane is also necessary. A power saw is very convenient but can be dispensed with. If you are capable of doing your own welding a good welding outfit is necessary. Four tips can be used for the various conditions that may arise, although six tips are to be preferred.

It might be well at this point to say a few words about welding. The welded joints on a fuselage, or anywhere on the ship, are one of the most important items to be considered. Unless you are an experienced welder you should never attempt to make a single joint on the ship. The main thing to be remembered is that the metal must flow evenly. It does not take a huge pile of metal on top of the joint to make it secure. It takes just a little metal in the joint if the joint is properly made. If you have a welder do your work for you be sure he has the proper size of tips for the torch and make sure he is competent to work on aircraft. Welding thin tubing is a great deal different from welding auto fenders or frames.

Before we go further into the construction there are a few other things we should consider. One of them is how and why wings rip off. It is very rare that wings do come off any more, but once in a while some lightplane builder does have this unfortunate accident. In most cases the wings will only come off at the end of a steep dive when the ship is pulled out too fast. Naturally, when a ship is pulled out of a dive rapidly, the angle of attack is very high. At certain points, in the high angle of attack condition, the lift on the wings is out of all proportion to the drag, and the resultant of this force is slightly ahead of the perpendicular to the chord line. This has a tendency to pull the wings ahead of the ship. If you ever saw a ship at the time the wings were coming off you would notice that the wings move ahead, toward the nose of the ship, at the same time that they are moving upward. For this reason never figure that the fittings for the front spar should be heavy while the fittings for the rear spar should be lighter. It is best to make them the same size unless you are

AERONAUTICAL UNIVERSITY

Founded by Curtiss-Wright

Government Approved - - - Accredited

AU ACCREDITED

The School the AVIATION Industry Calls on for TRAINED MEN

Right in the center of Air Transportation Industry where hiring is going on constantly.

Outstanding Faculty
Up-to-date Equipment

Reasonable Tuition—Easy Terms

Write for "Aviation As A Career"

Address Dept. P. A. - Curtiss-Wright Bldg.
1338 S. Michigan Blvd., Chicago, Illinois

WE DEFY COMPETITION!

Prices Slashed to New Low Levels! Compare these sensational values!

And remember this: SKYWAY'S high quality remains the same in spite of extreme lowered prices. Save money, and get more! Order from this ad Now!

FREE! WITH ORDERS OF $1 OR MORE — SPRAY for Your MODELS *or* 1 DOZEN SHEETS JAP. TISSUE *or* MODEL BUILDER'S KNIFE

Take advantage of this special FREE offer now! Experience what a real pleasure it is to do business with a model airplane supply house that keeps promises! Every order is shipped same day received! All materials are of highest quality! Prove this to yourself! Learn why so many builders, dealers and clubs deal with SKYWAY! Dealers! Send for prices.

10" BALSA SHEETS

1/32x2	.5 for 5c
1/16x2	.5 for 5c
3/32x2	.4 for 5c
1/8x2	.4 for 5c
3/16x2	.3 for 5c
1/4x2	.2 for 5c
1/2x2	.1 for 5c

BALSA PROP BLOCKS

1/4x3/4x6	.8 for 5c
1/2x3/4x6	.7 for 5c
1/8x1x8	.3 for 5c
3/4x1x8	.3 for 5c
1/4x1 1/4x12	.2 for 6c
1x1 1/2x12	.1 for 6c
1x1 1/2x18	.1 for 7c

10" BALSA LENGTHS

1/16x1/16	125 for 5c
1/16x1/8	60 for 5c
1/16x1/4	30 for 5c
1/16x3/16	25 for 5c
1/16x1/4	20 for 5c
2/32x3/32	40 for 5c
1/8x1/4	12 for 5c
1/4x1/4	10 for 5c
1/4x1/2	5 for 5c
1/2x1/2	4 for 5c

18" BALSA PLANKS

1x1, 1 for	4c
1x2, 1 for	8c
2x2, 1 for	15c
2x3, 1 for	19c
2x6, 1 for	35c

For 36" lengths double above prices and add 10c postage

15" BAMBOO

1/16x1/4...6 for	5c
Shredded...40,	5c

Japanese Tissue

All colors. Dz.	15c
Silver or Super-fine Tissue..	5c
Doz.	50c

Thinner Best

1 oz.	5c

Sheet Celluloid

2x6	2c
6x8	4c
12x16	15c

Clear Dope

1 oz.	5c
½ pt.	25c

Colored Dope

1 oz.	5c
⅓ pt.	30c

Clear Cement

1 oz.	5c
½ pt.	25c
1 pt.	45c

Wood Veneer

20x30", 1 for	9c
2 for	17c

Reed

1/32, 1/16" (add 5c per inch for props up to 10".)	.3 ft. 1c .3 for 2c

Wooden Wheels

½", 2 pair	3c
⅝", pair	2c
1", pair	4c
1⅜", pair	4c
1½", pair	7c

Celluloid Wheels

¾", pair	5c
1", pair	7c
1½", pair	9c
1⅞", pair	15c

Balsa Balloon Wheels

½", 2 pair	3c
¾", pair	2c
1", pair	3c
1¾", pair	5c
2", pair	8c
3", pair	14c

PROP. SHAFTS, 2 for 1c

PAUL-O-WINA JAP PROPS

5" (add 5c per inch for props up to 10".)	10c

Machine Props

5"	4c

Rubber Motors

1/16 sq. 20 ft.	5c
⅛ flat 20 ft.	5c

INSIGNIAS—
French, American, English, German

1¼"	4 for 3c
2"	1c

1 sheet of 24, 5c

Dummy Radial Engines

1½" Diam.	14c
2" Diam.	18c
3" Diam.	23c

DOWELS, 1/8x12 10c per doz.

SPOT WELDED HOLLOW ALUMINUM WHEELS

1" pr.	6c
1½" pr.	11c
1⅞" pr.	14c

Sheet Aluminum .006...sq. ft. 10c

Alum. Tubing 1/16", 3/16", ¼"....10c ft.

ALUM. LEAF, 2 sheets for 1c

WIRE, 6 ft. 3c 36" lengths.

NOSE PLUGS, large ..10c doz. small...5c doz.

Miscellaneous

Washers, ¼, ⅛ doz. 1c

Sandpaper, pkg. 5c

Model Pins, pkg. 5c

Brushes No. 8..5c

Thrust Bearings 1c

Bushings, doz..3c

Send 3c stamp for "Helpful Hints for Model Builders" and catalog for other bargains. FREE with all orders. ORDERS 75c or under 15c postage. Postage prepaid on orders over 75c. West of Mississippi add 10c extra. Canada add 15% extra. CASH OR MONEY ORDER—NO STAMPS—NO C. O. D.'s.

SKYWAY MODEL AIRCRAFT SUPPLY CO. 383 Seventh Ave., Dept. P Brooklyn, N. Y.

BE A PILOT • FLY A SHIP

If you are stumped at the high cost of training to qualify for a license and a good future in aviation—write immediately, enclosing stamp for information on opportunities now available under our

APPRENTICE PLAN

MECHANIX UNIVERSAL AVIATION SERVICE, Inc.
Strathmoor Sta., Dept. B2, Detroit, Mich.

capable of running a stress analysis and can determine exactly what size they may be. It is also wise to remember not to pull a ship out of a dive too steeply. Too many accidents have already been caused by some ambitious young pilot who thought he knew more about what the ship would stand than the designer.

For the builder who really wishes to know what determines safety in a ship, I should recommend that he get a copy of Aeronautics Bulletin No. 7-A. This is one of the free bulletins issued by the Bureau of Air Commerce for the use of the aviation industry. There are three of these bulletins which should be in every builder's possession. These are Nos. 7, 7-A, and 7-H. If you write to the Bureau of Air Commerce, Aeronautics Branch, at Washington, they will be glad to send you a list of the free bulletins which they publish, and I should advise all of you to get this list and make use of it. Bulletin No. 7 is the Air Commerce Regulations, and gives you all the air laws. No. 7-A is the Airworthiness requirements for aircraft, and must be followed in order to obtain a license or an A.T.C. on your ship, and 7-H is the Air Commerce Regulations governing repairs and alterations on licensed aircraft. Even though you may not be flying a licensed ship there is a lot of valuable information in this bulletin, and it will give you many suggestions as to how to make repairs on your ship in the event of a minor crash.

At the first reading of bulletin No. 7-A it appears like a very technical bulletin. However, if you take it slow and easy you will find that it is not as tough as it seems. Of course, it is really a designer's guide but still it is published in simple language. We need designers more than anything else in the industry, and any of you fellows who have ambitions in that field are to be encouraged. Whatever you do—don't give up, no matter how hard it seems!

Usually the first job in the construction of the ship itself is the fuselage. There have been a good many articles written about the construction details of a ship and we're not going over all the old ground again.

One thing to be done is to exercise the utmost care in preparing the steel tubing for welding. Cut it absolutely exact so that when you are making up a joint you don't have to pull the tubing together before you weld it. Take each member and tack it in place, then start at the nose and work back, traveling around the fuselage in a clockwise direction. However, this procedure will be up to your welder.

This will prevent excessive warping. Some welders start at the center and work both ways, but I believe the first method to be superior. Be sure that you have everything lined up the way it should be and that there are no parts to be added after you think you are all through. Be especially careful about putting in your fittings, and be sure that they are all exactly where you want them. The best welding rod to use for a chrome molly fuselage is a Norway Iron No. 7.

There are several things that enter into a welded joint that are not generally recognized by the amateur builder. In the first place, a welded joint in chrome molly tubing will have approximately the same strength as cast steel. This often leads to the question of why you should use chrome molly if it loses strength in welding. This is because the greatest stress in a structure is not at the joints but in the middle of the members. The weld is merely a means of attaching two members. Most of the stresses in a fuselage are compression stresses, while the stresses in struts are tensile stresses or stresses which tend to stretch the struts. It is for this reason that struts are usually attached by means of fittings and bolts. This method is also used to facilitate disassembly of the ship. If S.A.E. 1025 steel is used, the weld retains almost the original strength of the steel.

A great many builders are prejudiced against wooden fuselage construction. It is true that a wooden fuselage will not stand a crash as well as a steel tube structure, but as far as flying characteristics are concerned a wooden fuselage will often perform much better. Wood, if properly used, develops great strength and is much lighter, and weight is a very important item in light plane construction. One of the main disadvantages of wooden construction, aside from its failure in a crash, is the fact that it must be bolted and glued. The average lightplane builder is not familiar with the proper methods of glueing joints and a great many failures are caused by im-

(*Continued on next page*)

YOU SHARE OUR PROFITS!!

We are always working to further goodwill between our company and our customers and here is another one of the instances. We want our customers to share in our profits. In all orders sent to the HEATHE MODEL AIRPLANE CO., we will include HEATHE PROFIT-SHARING COUPONS which are redeemable for valuable gifts and prizes. All you need do is send us an order and we will send you your coupons and full particulars on how to secure these valuable prizes. Remember this is not a contest; everyone shares our profits. Write NOW! Every delay means losses to you.

POST-ROGERS LOCKHEED
a 3 ft. Scale Craft Flyer: a fitting souvenir of these two great immortals . . . . complete with aluminum cowl, carved prop, printed wood simplified plans, etc. . . . only **$1.50** plus 25c postage.

GAS MODEL BUILDERS

Here's what you've been waiting for . . . . a catalog and handbook of Accessories for constructing record-breaking gas models. Written by champions. Contains gas model hints, photos of champions and their models, success stories of their championship flights. Free—but will appreciate 3c postage for handling!

MONOCOUPE "145"
a 3 ft. Scale Craft Flyer: a model you would be proud to own . . . . make this your next model . . . complete with aluminum cowl and carved prop, etc. . . . . only . . . . **$1.25** . . . . 25c postage.

TYPICAL VALUES from the MODEL BUILDERS "BIBLE"

BALSA WOOD
(If 36" lengths are desired just double 18" price)

18" BALSA STRIPS
1/32x1/16..100 for .05
1/16x1/16..100 for .05
1/16x1/8 ..25 for .05
1/16x3/16..20 for .05
1/16x1/4 ..17 for .05
3/32x3/32..21 for .05
1/8 x1/8 ..20 for .05
1/8 x3/16..14 for .05
1/8 x1/4 ..10 for .05
1/8 x3/8 .. 8 for .05
3/16x3/16..10 for .05
3/16x1/4 .. 8 for .05
3/16x3/8 .. 6 for .05
1/4 x1/4 .. 8 for .05
1/4 x3/8 .. 5 for .05
1/4 x1/2 .. 4 for .05
1/2 x1/2 .. 3 for .05

18" BALSA PLANKS
1" x 1" .. 1 for .07
1" x 1½" .. 1 for .09
1" x 2" .. 1 for .11
1" x 3" .. 1 for .15
1" x 6" .. 1 for .25
1½"x 1½" .. 1 for .15
2" x 2" .. 1 for .20
2" x 3" .. 1 for .25
2" x 6" .. 1 for .45
3" x 3" .. 1 for .40
3" x 6" .. 1 for .75

COLORLESS CEMENT
1 oz....05 2 oz....08
4 oz....15 1 pt....50

BAMBOO
1/16 sq. x 12" 35 for .05
1/16x¼x11 .. 1 for .01
1/16x1/4x11 12 for .07

FREE
With every order of $1.50 or over, 250 ft. of the finest fresh ⅛ flat Para Rubber, free. Add 10c for handling charge of Free Rubber. Free supplies with all other orders.

SANDPAPER
Per package .... .05

18" BALSA SHEETS
1/64 x 2 ...5 for .10
1/32 x 2 ...7 for .10
1/16 x 2 ...7 for .10
3/32 x 2 ...6 for .10
1/8 x 2 ...5 for .10
3/16 x 2 ...4 for .12
1/4 x 2 ...3 for .11
1/2 x 2 ...2 for .12

BALSA PROPELLER BLOCKS
⅛x ¾x 5 ..7 for .05
⅛x ⅝x 6 ..7 for .05
⅝x1 x 7 ..3 for .05
⅝x1 x 8 ..2 for .05
¾x1¼x10 ..1 for .03
¾x1¼x12 ..1 for .04
1 x1½x12 ..1 for .06
1 x1½x15 ..1 for .07

COLORED DOPE
White, yellow, orange, red, green, olive drab, blue, black, silver, gold.
1 oz. ..... .05
2 oz. ..... .10
4 oz. ..... .19
1 pint (16 oz.)... .60

CLEAR DOPE
1 oz. ..... .05
2 oz. ..... .07
4 oz. ..... .13
1 pint (16 oz.)... .45

THINNER SAME PRICE AS CLEAR DOPE.

FINEST PARA RUBBER
1/32 x 1/32 30 ft. .05
225 ft. skein..... .30
.045 square 20 ft. .05
225 ft. skein..... .40
3/32 flat 20 ft.... .05
225 ft. skein..... .40
1/8 flat 17 ft..... .05
225 ft. skein..... .55
3/16 flat 12 ft... .05
225 ft. skein..... .80

SHEET CELLULOID
3x5 .. .05; 6x8.. .08

FLANGED BUSHINGS
Doz.
1/16 diam. x 5/32 .05
1/16 diam. x 7/32 .08
3/32 diam. x 1/4 .10
1/8 diam. x 1/2 .20

ALUMINUM LEAF
(.0008 of an inch in thickness. 3½ wide)
5 feet for..... .05

SHEET ALUMINUM
Thickness
.002" 6x6 ...1 for .04
.005" 6x6 ...1 for .05
.010" 6x6 ...1 for .06

JAPANESE TISSUE
(White)
2 for 5 Per doz. .18

COLORED TISSUE
2 for 5; 1 doz... .20

MUSIC WIRE
(straightened)
.014, .020, .028, .034
6 feet ..... .03

THRUST BEARINGS
(small or large)
Each ..... .01½
Per dozen ..... .15

MODEL PINS
Per package..... .05

DOWELS
1/16 dia. x 12" doz. .09
1/8 dia. x 18" 2 for .03
3/16 dia. x18..1 for .03
¼ dia. x18..1 for .04

REED
1/16" diam. 10 ft. .05
3/32" diam. 8 ft. .05
1/8" diam. 6 ft. .05

INSIGNIA SHEET
12 pr. and Rudder and Tail markings, with gummed back, each only..... .05

WASHERS
1/8 O.D. Per doz. .01
Per gross ..... .10
1/4 O.D. Per doz. .01
Per gross ..... .10

BALSA BALOON WHEELS
(Machine Turned)
½" diam. per pr.. 3c
⅝" diam. per pr.. 4c
1" diam. per pr.. 5c
1⅜" diam. per pr. 7c
1⅞" diam. per pr. 12c

CELLULOID PANTS
For ¾" or 1" wheel 15c
For 1⅜" or 1⅞" wh. 30c

ALUMINUM TUBING
1/16" O.D. per ft.. 9c
3/32" O.D. per ft.. 7c
1/8" O.D. per ft.. 8c
3/16" O.D. per ft..10c
1/4" O.D. per ft..10c

CELLULOID WHEELS
¾" dia. pr..... 5c
1" dia. pr..... 7c
1¾" dia. pr.....10c
1⅞" dia. pr.....16c

DUMMY RADIAL ENGINES
1½" dia. 18c
2" dia. 23c
3" dia. 34c

CELLULOID MOTOR AND DRAG RING COMBINED
1½" dia. ....each .18
3" dia. .....each .35

CAST PEDESTALS
for all size solid models
Each 10c

MODEL BUILDERS RAZOR KNIFE
Each 10c

BOMBS
¾" long..... 4c ea.
1¼" long..... 9c ea.
3" long.....14c ea.

2 BLADED PROPS
1½" ..... 9c ea.
2½" .....14c ea.
3½" .....18c ea.
4½" .....20c ea.

BAMBOO PAPER
2 sheets for..... .15

3 BLADED PROPS
1½" .....10c ea.
2½" .....15c ea.
3½" .....20c ea.
4½" .....25c ea.

PURSUIT MACHINE GUNS
ea.
¾" Pursuit Gun 5c
1" Pursuit Gun 5c
1¾" Pursuit Gun 10c

SWIVEL GUNS
¾" long..... 5c ea.
1" long..... 5c ea.
1¾" long.....10c ea.

DIE CAST WING AND TAIL LIGHTS
3 pc. to a set for
12" model.....10c ea.
15" model.....20c ea.
24" model.....30c ea.

MOTOR NOSE PLATES
For 1½" motor 10c ea.
For 2" motor 15c ea.
For 3" motor 20c ea.

ALUMINUM COWLINGS

Size	Anti-drag	Open	Closed
1½"	20c	20c	20c
2"	25c	25c	25c
2½"	28c	30c	30c
3"	30c	35c	35c

BALSA PROPS
5" 5c
6" 6c
7" 7c
8" 8c
10" 10c
12" 12c

How to Order—
Add 15c to orders under $1.50. Orders over $1.50 add 10% of order. Canada 10% extra. 36" lengths 10c extra. Add 10c for packing charge of free rubber.

Dealers, Clubs: Send for Latest Discounts

HEATHE MODEL AIRPLANE CO.
438-A10 East 98th St.-Brooklyn, N. Y.

Construction

(*Continued from page 61*)

proper glueing. Another common cause of failures is the piercing of a structural member at an important point to take a bolt, and this weakens it materially. However, you will find that a properly fabricated wooden fuselage will give you great satisfaction.

No matter whether you are using a wooden fuselage or not, the proper mixing and application of glue is of prime importance to the amateur builder. Your wing ribs are all built up from wood and unless you understand the proper method your ribs will not stand up.

There are three principal types of glue. These are Casein glue, Blood Albumen glue, and Animal glue. This is a glue prepared from sour milk. It is practically waterproof and will give excellent results if mixed and used properly. Blood Albumen glue is absolutely waterproof. This glue must be applied hot, however, and under extreme pressure, and for this reason it is unsuited to the amateur builder. This glue is used chiefly in the manufacture of aircraft plywood. Animal glue is a cheap type of glue which is very soluble in water and must be applied hot.

Casein glue comes in a powdered form and is mixed with water to prepare it for use. There are several brands of Casein glue on the market and they are all good. One is made by a prominent glue manufacturer, and while it is a bit high priced, it is an excellent glue. This particular glue is mixed with equal quantities of water by volume. Thus, if you are using one tablespoon of glue you should use one tablespoon of water. The water should be added to the glue slowly and mixed at the same time. The mixture changes from a creamy mass to a stiff dough which is very dry. This dough is then allowed to stand for approximately twenty minutes to a half hour and at the end of that time you will find that the glue has changed back to a smooth creamy mass of just the proper consistency for use. You should never, under any circumstances, add any water to this glue while it is in its doughy form. Another glue is mixed with water in the same manner except that the proportions of glue to water are very much different. This glue should be mixed smoothly with a motor mixer for twenty minutes. If it is mixed fast you are likely to whip air into it which destroys the strength of the glue. The glue should never be allowed to get lumpy. After this glue has been thoroughly mixed it should be allowed to stand for half an hour and is then ready for use. Whenever you buy glue you will find the directions for mixing it on the package and you should follow these instructions to the letter. Some of the directions may sound a bit foolish to you, but you will find that the manufacturer knows his glue a lot better than you do. All glue should be applied under pressure, but you will find that very little pressure is required for Casein glue. Other types of glue, such as Blood Albumen, should be applied at approximately five hundred pounds to the square inch. This is a bit beyond the reach of the average home builder.

In making up wooden ribs the standard Warren Truss rib is the best. This is the style shown in (Fig. 3) and is specified in ninety percent of the plans. There are other forms of ribs which are highly satisfactory, such as a double cap strip with a plywood web, but the Warren Truss is the easiest to build. Several builders have asked about the use of cement coated nails. If you expect your ship to stand up for a long time and give you some real service, cement coated nails should be used by all means. Ordinary brads or tacks are not good enough. For one thing they will pull out of the wood much easier than the others, and for another thing they will rust while the cement coated nails will not. Fiber is often specified for rib gussets and a few commercial ships such as the Aeronca use it, but for all practical purposes three-ply wood is the best. It is stronger than solid wood and is much easier to apply. In connection with gussets it might be wise to mention that it is just as easy to ruin a rib by using too many nails as to use not enough. As a rule the fewer nails you use the better the job will be. Figure 4 will give you an idea as to an ideal arrangement of nails and gussets. Great care must be exercised in laying out ribs so that the wing curve will not be distorted when the rib is taken from the mold, and that the ribs will fit over the spars properly.

In laying out the strut fittings for the wings it must be remembered that there are several types of stress present at the point of attachment of these fittings. Therefore the fittings should be arranged and mounted in such a manner that the fitting and the strut are in a perfect line. This will take off all twisting stress due to a misalignment of the fitting and the strut, and will stop any tendency for the bolt to pull out. (Fig. 5.)

Several builders have asked why it was permissible to use aircraft cable for the drag bracing of the wings a few years back and why that has been forbidden now. This is because the cable has a tendency to stretch after it has been in use for some time and it is necessary to open up the wings and pull up on the turnbuckles again. If hard wire is used this is unnecessary.

Before installing hard wire in the wings it is necessary to inspect it thoroughly. If there is the slightest nick in the wire it is unfit for use because whenever a steel bar, rod, or piece of steel wire has a nick in it, it is in a seriously weakened condition. This is due to what the engineers call a concentration of stresses. If the steel is dressed down so that it is uniform all along its length the strength will be restored. Naturally it is impossible to dress down hard wire. If this wire has once been bent sharply it should be discarded. This bending will also weaken it seriously. You must remember that this wire is not put in to merely stiffen the wing but is in there to carry certain loads, and if one wire should let go, it would not only throw the ship out of rig but would render it unsafe to fly. Care should also be taken in the construction of fittings for this wire. If there are any sharp edges on the holes which have been drilled to take the wire it is likely to cut the wire in time.

There is just one more bit of advice in connection with the assembly of the wings. Always put any bolts or clevis pins in with the heads up. Then if a cotter pin or safety wire should let go, there is less danger of the bolt or clevis pin dropping out. This precaution should be taken for the construction of the entire aircraft to insure a maximum of safety.

COLT 45 CAL. AUTOMATIC $1.00

Colt 45 Automatic pistol model kit $1.00

Thompson Sub Machine Gun (half scale) Construction kit with machined barrel, magazine, necessary hardware, and working plans.....$1.00
Thompson Sub Machine Gun (full scale) kit..... 3.00
Savage cal. 32 automatic, machined barrel..... .75
Luger 9 M/M auto. with 4" machined barrel..... 1.75
Colt single action Frontier revolver..... 1.45
Send postpaid in U. S. A. No stamps please. Checks 15c extra.

● FREE! ●
25 cal. Colt Automatic regular 50c kit free with every order of $2.00 or more.

These beautiful kits are complete in every detail, made of the best basswood. All parts are cut to shape and require only a short time to finish.

GUN MODEL CO., Dept. K10, 2908 N. Nordica, CHICAGO

BUILD up HOURS in a HEATH!

Easiest, most economical way to build up flying time for that pilot's license you're working toward. Its stability, strong, simple construction and low landing-speed make the Heath America's most popular light plane. Build and fly your own Heath—quickly and inexpensively familiarize yourself with the fundamentals of airplane construction and flying. **Here is your chance**—learn aviation from the ground up. Factory-welded fuselage eliminates difficult riveting and bolting—simplifies construction. Starting Kit—Special, $8.00. Complete Kit, less motor, $199.00. Check Coupon and Mail TODAY.

HEATH AVIATION COMPANY,
Benton Harbor, Michigan
Enclosed find: ( ) 10c for full data.
( ) $8.00 for Starting Kit.
Name .....
Address .....

BUFFALO PUBLIC LIBRARY
DEPARTMENT OF TECHNOLOGY

Lambert's

(*Continued from page 28*)

LAMBERT TWIN MONOCOACH H:

Overall Wing Span	36'
Overall Length	24' 6"
Overall Height	7' 6"
Engines and Horsepower	2 90 HP. LAMBERT R-266's.
Wing Area	231.2 sq. ft.
Power Loading	17.9 lbs./hp.
Wing Loading	13.9 lbs./sq. ft.
Empty Weight	1,882 lbs.
Useful Load	1,338 lbs.
Payload	880 lbs.
Baggage	200 lbs.
Gross Weight	3,220 lbs.
Gasoline	70 gal.
Oil	5 gal.
Maximum Speed	160 mph.
Cruising Speed	130 mph.
Landing Speed (no flaps)	50 mph.
Landing Speed (flaps)	40 mph.
Rate of Climb	700 ft." min.
Service Ceiling	12,000 ft.
Range at Cruising Speed	900 mi.

END.

Racer

(*Continued from page 42*)

selage and airfoil sections. The wing ribs are of smaller steel tubing than that used in fuselage. All joints are welded.

The wing is tapered from a chord of six feet at the junction with the fuselage to less than three feet at the outermost rib at the wing tip.

Some of its other characteristics are: 500 pounds total weight, officially clocked time of 212 m.p.h., landing speed 40 m.p.h. with flaps down, and a wing of unconventional thickness in a racing ship. With an exceptionally long chord at the wing root, it has a very small aspect ratio.

It is provided with gas and oil tanks sufficient to give it a cruising range of 1,500 miles. These tanks carry 65 gallons of gas, 40 gallons in the fuselage tank and 12½ gallons in each wing tank. A wooden propeller of half the total span is used.

Its miniature landing gear is braced with wires attached to rubber shock cord, and supports two landing wheels that were originally manufactured for use as tail wheels.

Riley Burrows, its designer, builder and pilot, built the plane and test hopped it at Grand Central Air Terminal in Glendale, California.

Now that the mechanical element of the racer is determined, we must still combat luck, opportunity and the human element of the pilot, all of these factors being far more uncertain than the mechanical end of the racer. From the mechanical specifications, and from what we know of the competition it will meet, this little ship should stand well up to the front—but we are not so certain in regard to the other elements.

It is just possible that the low landing speed of 40 m.p.h. will have to be sacrificed in favor of a higher top speed — flaps or no flaps — but this is simply surmise. The top as determined by test, seems high enough.

Follow the example of the nation's foremost pilots and aircraft designers. Make your selection from General's complete tire line. Whether you need the Streamline type, Intermediate or High Pressure tire, it will pay you to bring your problems to General—the air minded company that originated and perfected the famous Streamline Tire.

GENERAL AIRPLANE TIRES

GENERAL TIRE AND RUBBER COMPANY
AKRON, OHIO

Send one thin dime for

ORT'S NEW CATALOG

and save many dollars!

HUNDREDS OF AMAZING AVIATION BARGAINS

Like These!

This new 1936 catalog describes the greatest collection of aviation bargains I have ever offered. There is only room here for a few examples. 56 pages of stuff, at prices that will make you whistle. Everything from jewelry to gaskets! Profusely illustrated in colors on fine paper so you can see just what you get before you buy.

This catalog costs me 30c each **just to print.** And I'm sending it to you for **one thin dime,** to cover the cost of mailing. You get your dime back with your very first order! No need to tell you my reputation. Everybody in aviation knows me and the big outfit I got. And my famous money-back guarantee protects you. So send me that thin dime or stamps and let me send you hundreds of dollars worth of savings. Today! NOW!

Karl Ort.

Real black leather, without gold propeller and wing on front, 32 pages 5½"x6". Approved by Dept. of Commerce. Postpaid, only 69c. With Morocco cover and modernistic airplane design $1.00 postpaid.

SPECIAL GET-ACQUAINTED OFFER

Look at the swell goggle and helmet outfit I am wearing above! Wonderful Snugfit Goggles and soft silky white Gabardine Helmet combination for only $2.99 postpaid. Would cost you $4.00 anywhere else. Sold below cost to get you acquainted with me. Give hat size. Both Goggles and Helmet as illustrated

$2.99 postpaid

AVIATOR'S LAPEL PIN

Ladies love it—on you or on themselves. Swell gift! A Sterling silver gold lettered lapel pin. **Postpaid only 96c.**

BARGAIN ASSORTED BOLTS, ETC.

Assortment No. 2—500 pieces as illustrated including rustproof, nickel steel aircraft bolts in all sizes. Also washers, clevis pins, ferrules, tubing clamps, machine screws, etc. List price over $60. Ort's price . . . . **$2.98.** Shipped express collect. No C.O.D. shipments.

FREE TOOL BAG

with every $2.98 Bolt Assortment order you get absolutely free a high grade $1.25 suede, zipper tool bag 12" long.

SEND WITH ONE DIME TO

KARL ORT

666 W. POPLAR ST. YORK, PA.

Dear Ort: You bet I want your new 1936 catalog right away. Here's your thin dime (Canada, 2 cents) I want the free tool bag. Send me my free catalog.

Name .....

Address .....

City ..... State .....

Rickenbacker

(*Continued from page* 18)

seem to realize this. For, even when we sell them what we have invented, we are two or three years ahead of them and the rewards for these sales spur our men on to conquer new fields. In experimentation and inventive power, we are leaps ahead of the rest of the world."

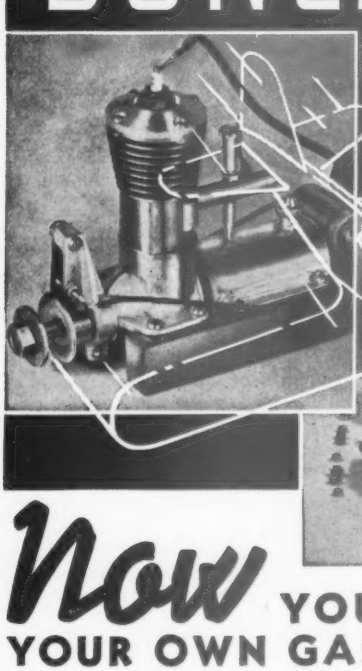
The flyer spoke intelligently and convincingly on commercial aviation in the United States as it is related to military necessities.

"Our planes could only be used for passenger purposes," he admits. "They are not combat planes and would be awkward as bombing ships. But our landing fields bind the nation together. We are training great numbers of men as pilots, mechanics and radio technicians. The development of radio beam flying would be priceless in the event of an invasion.

"In addition, commercial laboratories are constantly experimenting to advance the quality of airplanes. In the event of war all these excellent improvements and facilities would become the property of the government."

It is a far cry from the skies of France almost two decades ago to those of North America today. But from the above flash-back into history, and survey of our own country's present air position through the eyes of an expert, you should derive some rather good ideas.

BUNCH *presents the* MIGHTY MIDGET



Now YOU CAN BUILD YOUR OWN GAS MOTOR FOR $9.85

The Mighty-Midget is not a toy—it's a high-priced, precision-fitted motor, shipped to you with complete instructions for assembling and block-testing. Every part is machine finished and made of the finest materials. The piston is accurately fitted for highest possible compression.

The Mighty-Midget, assembled, sells for $17.50. You buy it in kit form for only $9.85. . . . All that its name implies—a super-performer of tremendous power, worthy of our unqualified endorsement. Specifications. **Flying Weight with Batteries 18 oz. . . Bore 13/16" . . Stroke 13/16" . . Speed 500 to 7000 rpm with design propeller.**

Send for a Mighty-Midget Gas Motor Kit—assemble it yourself and save money.

You'll want a champion gas model plane for your Mighty-Midget, so don't overlook the Scorpion Major—the outstanding airplane kit of the year—and only $12.50 complete. With this plane and the Mighty-Midget, you can't miss. Get them both and win every event. **Order today . . . and remember, the Mighty-Midget is a champion.**

BUNCH MODEL AIRPLANE COMPANY
2303 S. HOOVER STREET, LOS ANGELES, CALIF.

BRITISH AGENTS: MODEL SUPPLY STORES, 46 DERBY RD., PRESTWICH, LANCS.

Air Races

(*Continued from page* 46)

yet there is a vast difference in the volume of sales. Commercial automobiles started to appear on the streets in noticeable number about the year 1900. The first airplane flew in 1903 and planes became quite common in 1908-1909, or only nine years later.

In 1901-1904, as a member of the Rathbun-Doyle Company, I sold automobile kits for homebuilders, built a few cars myself and was sales-agent for the German "Benz" and the American Rochet-Schneider. I am therefore certain of my dates and data. Later, I took on the "Pullman," a big American deluxe car, the first to have a wheelbase of 120 inches, one of the first six-cylinder cars and the first equipped with a self-starter. From 1909, I have been closely associated with aviation.

Selling cars in those days was an uphill job. In the first place, the average prospective customer was all filled up with newspaper scare-heads, dealing with bloody death at the races. He didn't see just how one of these "red-devils" (as they were then known) would fit into his private life. To his mind, buying a car was on a level with buying a circus elephant or a piece of artillery for his children to play with. When we went out to sell from $3,000 to $5,000 worth of automotive merchandise, we had to put the soft pedal on the racing idea. And how well I know it!

In the second place, all the races had done was to develop speed. The carburetion was terrible, flexibility zero and the ignition was worse. Progressive type transmissions, suitable for track use in the hands of expert racing men, were entirely unsuited for road work. On the track, all that was necessary was to put on full speed ahead, but on the road it was necessary to slow down in traffic and to introduce a considerable amount of speed control with the throttle without changing gears every minute, a feat impossible with carbureters developed for racing purposes.

Personal comfort, completely ignored on racing-cars, was also essential to private ownership and was a problem that was not solved by racing. Up to that time, the cars had been provided with four nice hard springs that were about as stiff and unyielding as four burglar's crow-bars. Again, women found that driving a gas car was usually out of the question unless they found some nice kind man who was strong enough to crank-over the heavy engines by hand, a tough job at any time but particularly so in winter with stiff oil, questionable gasoline and primitive carbureters without hot-spots. And absolutely nothing came from the race-tracks to relieve this situation.

And so, let us sum up the principal problems that were solved entirely outside of the race-track and the solutions

(*Concluded on page* 66)

Solid Gas

(*Continued from page 32*)

or for filling into tanks. There is nothing to equal a pipe when it can be employed, but easy entry also is combined with easy exit, so the purpose of the usage is all important.

At the time there was considerable argument and discussion in the public press as to the relative evaporation between the fuel in the two different states. Many tests were made of all kinds, and the consensus of opinion seemed to point to very little difference, other things being equal.

Claims that containers of ordinary gas tightness would suffice were strongly denied, surface evaporation from equal surfaces of the jelly and the liquid being about the same.

It is possible that the effective evaporation from the surface is but little influenced by the presence of flame on one part of the surface and that is why the flame only burns lazily when the fuel is in the gelatinous state.

But if allowed to stand in the open room, for example, it is quite possible that the rate of evaporation of equal weights of the fuel might be equal to or greater in the case of the solid because evaporation occurs from all sides, a greater surface being exposed to the air stream as the bulk leaves the sides of the container.

We are not here particularly interested in the cost of the process but as a passing note it was stated that the process described cost in Europe five francs, about a dollar at that time, per long ton of fuel treated. The fat was recoverable and the alcohol burned in the engine or other agent. As to whether this is representative of present day values nothing is known by the writer.

To the engine user the matter of most interest is "what does this kind of fuel do and how can it be used." It was to find this out in the first place that the writer was engaged to examine and report on the Roumanian process in 1910. This was done from the viewpoint of the motorist and a series of tests first made in his laboratory in London. First it was necessary to find some way of obtaining vapor from the jelly and controlling its rate of flow.

Briefly and in a crude way this was handled by loading the fuel chunks into a box placed on the running board of the car, the box had a false bottom covered with wire mesh, the fuel rested on the mesh and a loaded board placed on the top of the fuel. The space below the mesh formed a mixing chamber through which warm air was drawn and the action was as follows: The load on the surface of the fuel caused it to pass through the wire mesh in the form of stalactites, small at first, but soon becoming an inch or so in length. These hanging down in the air stream offered considerable surface so that there was in effect a surface carbureter.

At a direction normal to the length of these pendules, warm air was drawn by the suction of the engine so that all that was necessary was to connect up a mixing valve, there being no need for a carbureter of the usual type.

Nowadays it would be simple to produce a better apparatus but the one used was sufficient for demonstration of the principle. Tests were published at the time and are on record and naturally were much criticised, particularly as some were made on a two cycle engine. However, they were comparative, and conclusions were reached at the time to the effect there was some advantage from the combustion viewpoint.

It is probable that this was due to distribution in the four cylinder type of engine used, as much as to any special feature in the fuel. Naturally, a more homogeneous mixture was present in the system when using the surface carbureter. It should be pointed out that selective evaporation of the mass of the fuel does not take place when the fuel is jellified as is the case when the bulk liquid is so handled. This may help to account for the results.

There is no reason why large engines cannot operate on solidified fuel as it is merely a matter of attaining the liquid state rapidly enough and at the right place, and getting rid of any residue which may accumulate in the tanks.

END.

MR. DEALER!

—AGAIN WE CUT OUR PRICES!!

If 18" lengths are desired, take ½ of 36" length price.
If 3" widths are desired, double price of 2" widths sheet Balsa.
Thinner same price as clear dope.

BALSA
36" LENGTHS PER 100

1/32x1/16 .....10c
1/16x1/16 .....10c
1/16x3/32 .....18c
1/16x1/8 .....19c
1/16x3/16 .....24c
1/16x1/4 .....26c
1/6x1/2 .....60c
3/32x3/32 .....24c
1/8x1/8 .....29c
1/8x3/16 .....48c
1/8x1/4 .....52c
3/16x3/16 .....65c
1/4x1/4 .....80c
1/4x1/2 .....$1.50
1/2x1/2 .....2.15

36" PLANS

Scale craft flyer plans with movable controls: Post-Rogers Lockheed or the Monocoupe. $1.50 per doz. or $9.00 per hundred.

36" SHEETS

1/64x2 ....10 for 14c
1/32x2 ....10 for 14c
1/16x2 ....10 for 17c
3/32x2 ....10 for 20c
1/8x2 ....10 for 22c
3/16x2 ....10 for 31c
1/4x2 ....10 for 40c
½x2 ....10 for 75c

BALSA PLANKS
36" Lengths

1x1, each 6c
1x1½, each 9c
1x2, each 13c
1x3, each 20c
1x6, each 35c
1½x1½, each 25c
2x2, each 25c
2x3, each 35c
2x4, each 45c
2x6, each 60c
3x6, each $1.25

COLORLESS CEMENT

1-oz. bots., ½ doz. 23c
2-oz. bots., ½ doz. 40c
4-oz. bots., ½ doz. 70c
1 pt., each 45c
1 qt., each 75c
1 gallon, each.. $2.00

CLEAR DOPE OR BANANA OIL

1-oz. bots., ½ doz. 23c
2-oz. bots., ½ doz. 40c
4-oz. bots., ½ doz. 70c
1 pt., each 40c
1 qt., each 65c
1 gal., each.. $1.75
Thinner same price as clear dope.

JAPANESE TISSUE

White, per doz... 12c
Colored, asst., per doz. 15c
All colors.
Silver, per doz... 21c

For a short time only, we have cut our prices to the bone. We are doing this for the sole purpose of acquainting new customers and friends with our products. We feel sure that once these friends get to know the DIAMOND quality, they will stick by us forever. Time and again, dealers have written us commending us on our services, prices, and quality. You, too, can feel the utmost in security if you deal with a reliable supply house.
Don't hesitate. Order NOW while prices are lowest.

STANDARD PITCH BALSA PROPELLER BLOCKS
Per Dozen

½x⅝x5 ..... 5c
⅝x⅝x6 ..... 6c
⅝x1x7 ..... 14c
¾x1x8 ..... 18c
⅞x1x9 ..... 25c
¾x1¼x10 ..... 30c
¾x1¼x12 ..... 35c
1x1½x12 ..... 40c
1x1½x15 ..... 55c

BAMBOO

1/16 sq. x 14, 1 gross for 10c
1/16x¾x11, 1 doz. for 5c

REED

1/32 or 1/16 dia.. 50 ft. for..... 10c
3/32 or ⅛ dia., 50 ft. for 20c

ALUMINUM COWLING
Closed or Open

1¼" dia., 3 for...25c
2" dia., 3 for...35c
2½" dia., 3 for...43c
3" dia., 3 for...55c
4" dia., 3 for...80c

FRESH PARA RUBBER AAA GRADE
Per 225' skein

1/32 sq. 25c
.045 sq. 35c
3/32 flat 35c
1/8 flat 40c
3/16 flat 70c
Lb., any size...$1.00

DOWELS

1/16" dia. x 12", 100 for 55c
25 for 20c
⅛" dia. x 36", 100 for $1.50
25 for 45c
3/16" dia. x 36", 100 for $2.25
25 for 75c
¼" dia. x 36", 100 for $3.00
25 for 1.00

SHEET CELLULOID
(Transparent)

12½x16, each..... 19c
6x8, doz. 65c

INSIGNIA SHEET

12 pr. & rudder and tail markings with gummed back. Doz., 36c; 100, $1.75

DUMMY RADIAL ENGINES
(Celluloid 9 cylinders)

1½" dia., ½ doz. for 80c
2" dia., 3 for..... 65c
3" dia., 3 for..... 85c

CELLULOID MOTOR AND DRAG RING COMBINED

1½" dia. ...3 for 40c
3" dia. ....3 for .75c

NOSEPLUGS, HARDWOOD

1 doz. 5c
100 ..... 40c

CELLULOID WHEELS

¾" dia., per doz. 24c
1" dia., per doz. 25c
1⅜" dia., per doz. 35c
1⅞" dia., per doz. 60c

BALSA BALLOON WHEELS
(Machine Turned)

⅝" dia., per doz. 9c
¾" dia., per doz. 11c
1" dia., per doz. 14c
1⅜" dia., per doz. 19c
1⅞" dia., per doz. 38c
3" dia., per doz. 85c

BIRCH WHEELS LIGHT AND STRONG

¼".....per doz. 5c
⅜".....per doz. 6c
1".....per doz. 8c
1⅜".....per doz. 10c
1⅞".....per doz. 15c

BRASS BUSHINGS OR EYELETS
Per 100

1/16 diam. 12c
3/32 diam. 15c
⅛ diam. 18c

THRUST BEARINGS (Hard Steel)

Small, per dozen. 6c
Small, per gross..55c
Large, per dozen. 7c
Large, per gross..70c

WASHERS PER 100

⅛ brass O. D.....5c
¼ copper O. D....5c

WIRE PER 100 FT.
(Straight Lengths)

No. 6 ..... 15c
No. 8 ..... 18c
No. 10 ..... 20c
No. 12 ..... 23c
No. 14 ..... 26c

SHEET ALUMINUM
Per 5 ft.

.002 thick 35c
.005 thick 50c
.010 thick 75c

ALUMINUM TUBING
(Special 1/100" wall)

1/16 O.D., 5 ft...30c
3/32 O.D., 5 ft...32c
⅛ O.D., 5 ft...32c
3/16 O.D., 5 ft...40c
¼ O.D., 5 ft....45c

COLORED DOPE

White, yellow, orange, blue, red, green, olive, drab, black, silver, gold or gray.

1-oz. bottles, per ½ doz. 30c
2-oz. bottles, per ½ doz. 55c
4-oz. bottles, per ½ doz. $1.00
1 pt. each 80c
1 qt. each 85c
1 gallon, each..$2.25

SANDPAPER
5 Pieces to the Pack
Per doz. pkgs.....25c

HIGH GLOSS

To shine up colored models.
1-oz. bottles, per ½ doz.....30c
2-oz. bottles, per ½ doz.....55c
4-oz. bottles, ½ doz. $1.00

CELLULOID PANTS

For ⅝" or 1" wheels, ½ doz. .50c
For 1⅜" or 1⅞" wheels, ½ doz..75c

¾ FINISHED BALSA WHEEL PANTS
Ready for final sanding

To fit: 6 pr.
½" wheels 36c
⅝" wheels 36c
1" wheels 36c
1⅜" wheels 54c
1⅞" wheels 54c

PROP SHAFTS
(Hard Steel)
One size fits all models
Per dozen 10c
Per gross 75c

REAR HOOKS
(Hard Steel)
One size fits all models
Per dozen 10c
Per gross 75c

DIE-CAST BOMBS

¾" long, 3 for...10c
1¼" long, 3 for...20c
3" long, 3 for...35c

PURSUIT or SWIVEL MACHINE GUNS (DIE CAST)

¾" long, 3 for...10c
1" long, 3 for...15c
1¾" long, 3 for...25c

2-BLADED PROPS (DIE CAST)

1½" long, 3 for...20c
2½" long, 3 for...35c
3½" long, 3 for...45c
4½" long, 3 for...55c

3-BLADED PROPS (DIE CAST)

1¼" long, 3 for...25c
2½" long, 3 for...35c
3½" long, 3 for...50c
4½" long, 3 for...60c

DIE-CAST WING AND TAIL LIGHTS
3 Pcs. to a Set

For 12" model, 3 sets 20c
For 15" model, 3 sets 40c
For 24" model, 3 sets 60c

MODEL PINS

Per doz. pkgs....35c

MACHINE CUT PROPS

5"....per doz. 30c
6"....per doz. 38c
7"....per doz. 48c
8"....per doz. 50c
10"....per doz. 85c
12"....per doz. $1.00

WOOD VENEER
(For scale model work)

20"x30", 3 sheets for 25c

GENUINE SUPER-FINE TISSUE
(Cover your champion endurance ships with this paper.)
18x24, per doz...75c

ALUMINUM LEAF

.0003 of an inch thick. 3½" wide, 100 ft. for 35c

FRESH RUBBER A GRADE

3/32 flat, skein 250 ft. 20c
⅛ flat, skein 250 ft. 25c

★ ★ ★
FREE DEAL
★ ★ ★

A Big Bonus for a Limited Time Only!

With each order for $2.50 or more of supplies we give free skein of para rubber; regular wholesale price 40c; retail value $1.40 FREE! With each order for $5.00 or more of supplies we give Free—1 skein of para rubber and 2 dozen large insignia sheets. Wholesale price $1.17; retail value about $4.00.

FREE CATALOG
Just off the Press!
Listing everything and anything you may need in model airplane kits and supplies. Everything at rock bottom prices. Get yours today.
HOW TO ORDER
No orders under $2.50 . . . all orders shipped express collect at these low prices.

DIAMOND
Model Mfg. Supply Co.
915 A10 Saratoga Av. Brooklyn, N. Y.

Air Races

(*Continued from page 64*)

that have made the automobile the useful and popular vehicle that it now is.

(1) Carbureter improvements for giving better speed flexibility and easier starting. (2) The present selective type transmission that made gear shifting an easy task. (3) Battery ignition in place of magneto ignition. (4) Electric headlights in place of kerosene lamps. (5) Hot-spot manifolds that made cold weather driving practicable. (6) Shock-absorbers and improved tires, together with better springing, that made it possible to remain on the seat while going over rough roads. (7) Self-starters that made it possible for every member of the family to drive the car. (8) Self-centering steering gear. (9) Enclosed bodies for comfort in winter. (10) Elimination of noise and vibration. (11) Efficient mufflers. (12) Balloon tires. (13) Air and oil filters; etc.

None of the above items were remotely connected with racing and yet they were essential for commercial success. And all of these great and necessary developments proceeded without the necessity for loss of life or property. In a similar manner, the development of the commercial airplane will proceed without pylon polishing contests. I am not prejudiced against racing as racing, but I have been intimately connected with the history of automotive development so long that, to my certain knowledge, racing has a negligible effect upon true improvement.

What we require in a practical commercial airplane is not more speed and larger engines. Any damn fool can increase speed by reducing the weight per horsepower, but he pays the penalty for his folly in a hundred different ways. Flying engines may be spectacular and have the air of romance and daring, so appealing to boys and young men, but they are nothing to conjure with in commercial production.

Before we open the pocket-book of J. Rufus Smith and get him to the point where he signs on the dotted line, we must sell him something beside speed. J. Rufus likes to ride in comfort and safety and does not propose to spend his spare time tearing around pylons. He likes to go places and see things, far above the Sunday drivers, the congested highways and red stop-lights. It is not necessary for him to fly 422.7866 miles per hour when he wishes to pay a call at his daughter's home. Peace, comfort and safety are far more to him than a world's record flight between Horseneck, Ind., and Peevy's Junction, Iowa.

And what have we to offer him that has been developed at the race-meets? Well, practically nothing, as we might jolly well say, unless he is a fire-chief. His eighteen year old son may like to step on it and land among the morning's headlines, but the son is not of much importance to the industry because he can't do much buying with his $2.00 weekly allowance. It's the Old Man that pays and pays and pays, and it is therefore more essential to appeal to the O. M. than the son if we wish to get anywhere with airplane sales and production.

And here we hit upon one of the principal reasons why airplane sales to private owners have never amounted to much. The appeal has always been to the young man without funds, while the older man and his pocket-book have been ignored. I have carefully watched this aspect of the affair since 1909 and it has been consistently the same old story for the past twenty-six years.

Airplane builders have always planted their seed on barren soil, walking painfully for a thousand miles to find a nice rocky pasture for their sowing when fertile fields lay just outside the backyard fence. They persist in building what strikes their fancy and disdain to note what is in demand. If there ever was an industry that persistently followed a dumb sales program, it is the aviation industry. And the proof of this statement is the fact that the sale of planes for private ownership is pitifully low.

END.

LOOK AT THESE BARGAINS

You can't beat these prices
You can't beat Imperial Service
COMPARE - - CONVINCE YOURSELF

FREE With all orders for $1.00 or over Your Choice of 2 OZ. CLEAR CEMENT AND 100—1/16 x 1/16 x 18 BALSA or 1 SKEIN .045, 1/16 sq., or 1/8 FLAT RUBBER

If rubber is desired, add 10c handling charge

18" BALSA
1/16x1/16..100, 5c
1/16x1/8 40 for 5c
1/16x3/16, 20, 5c
1/16x1/4 16 for 5c
1/16x1/2 5 for 5c
1/8x1/8...32 for 5c
1/8x1/4 20 for 5c
1/8x3/16 15 for 5c
1/8x1/4 10 for 5c
3/16x3/16...8, 5c
1/4x1/4 6 for 5c
1/4x1/2 3 for 5c
1/2x1/2 2 for 5c
1/64x2 6 for 10c
1/32x2 3 for 10c
1/16x2 3 for 10c
3/32x2 1 for 10c
1/8x2 ...6 for 10c
3/16x2 3 for 9c
1/4x2 ...3 for 10c
3" sheets or 36" lengths, double above prices, add 10c extra for 36" lengths.

18" PLANKS
1x1 4c; 1/8x3 6c
1x1 1/2 8c; 1x2 10c
1x3 15c; 2x2 18c
2x3 23c; 3x6 35c
3x3 40c; 3x6 75c

TISSUE, AA
All col., doz. 18c
Silver ....ea. 5c
Superfine, white 5c

WHEELS per pr.
Brch. Balsa Celu.
1/2 .01 .02 ..
3/4 .02 .03 .05
1 .03 .04 .07
1 1/2 .04 .06 .10
1 3/4 .07 .08 .16
3 .. .15 .30

PINE WHEELS, pair
Both sides alike
3/4".4c; 1" ..6c
1 3/4".8c; 1 3/4".12c

NOSE BLOCKS
1x2x1 .....1c
2x2x1 .....2c
2x2 1/2x1 .....3c
3x3x1 .....5c
3x3x2 .....8c
3x3x3 .....10c

INSIGNIA
24 and stripes 5c

WASHERS
1 doz. 1/4 or 3/4 1c

THRUST BEARINGS
Small ...doz. 8c
Large ...doz. 12c

PROPELLER BLOCKS
1/2x 3/4x 5 8—5c
1/2x 3/4x 6 6—5c
3/4x1 x 7 4—5c
3/4x1 x 8 3—5c
3/4x1 1/4x10 2—5c
3/4x1 1/4x12 3c ea.
1 x1 1/2x12 4c ea.
1 x1 1/2x15 6c ea.

SHEET ALUMINUM
.0003x3 1/2 ..ft. 1c
.005 in. 6x6 5c
.010 in. 6x6 6c

CLEAR DOPE
1 oz. 5c; 2 oz. 9c; 4 oz. 17c; 1/2 pt. 25c; pt. 45c.

THINNER
Same as clear dope

COLORED DOPE
1 oz. 5c; 2 oz. 9c; 4 oz. 17c; 1/2 pt. 35c; pt. 55c.

CLEARCEMENT
1 oz. 5c; 2 oz. 9c; 4 oz. 17c; 1/2 pt. 30c; pt. 50c.

MACHINE-CUT BALSA PROPS
5" 4c; 6" 5c;
7" 6c; 8" 7c;
10" 8c; 12" 10c.
15" 15c

BAMBOO
1/16sq.x12, 36, 5c
1/8x1/4x15 dz. 10c

DOWELS
1/16x6 ...doz. 5c
1/8x18 ...2 for 3c

WIRE
6-8-10-12-14 .....2 ft. 1c

WOOD VENEER PAPER
20x30 ..1 for 10c

CELLOID
6x8 .....5c
12 1/2x16 .....18c

WING AND TAIL LIGHTS
12" 10c; 15" 15c; 24" 20c.

RUBBER
.045 ....25 ft. 5c
1/16 sq., 20 ft. 5c
1/8 flat ..18 ft. 5c
Skein 50c

DUMMY RAD. ENGINE
1 1/2" d. 10c; 2" d. 15c; 3" d. 20c.

ENGINE AND COWL ATTACHED
1 3/4" dia. 35c
3" dia. 35c

CELLULOID PANTS, per pair
1/2" to 1" ..18c
1 1/8" to 1 7/8" ..33c

METAL PROPELLERS
2 blades 3 blades
1 1/2" ..5c 08
2 1/2" 10c 10
3 1/2" 15c 20
4 1/4" 20c 25

ALUM. TUBING
1/16 or 1/8, ft. 7c
3/16 or 1/4, ft. 10c

ALUM. COWLINGS
1 1/2" 15c 2" 18c 3" 25c
Specify whether anti-drag, closed, or open.

BOMBS
3/4"..4c 1 1/4"..7c 8"..12c

GUNS WITH RING MOUNT
1 1/4" 10c 1 3/4" 15c

PURSUIT MACH. GUNS
3/4", 1 1/4" or 1 3/4", each 5c

CAMEL'S HAIR BRUSHES
Small 3c; Lge. 5c

BUSHINGS
1/16 ....4 for 1c

WONDER WATER SPRAYER 15c

MODEL PINS
pkg. 1/2" or 1" 5c

SANDPAPER
Doz. sheets....5c

PROP. SHAFTS,
doz. 8c

REED
1/32-1/16-1/8, ...2 for 1c

NOSE PLUGS
1/2" .....doz. 8c

FREE
POSTAGE ON ALL ORDERS IN UNITED STATES FOR 75c OR OVER, EXCEPT WEST OF THE MISS., ADD 10c; CANADA, U. S. POSSESSIONS, AND FOREIGN, ADD 15%. UNDER 75c, ADD 10c
No C.O.D.'s. No Stamps

20 IN. FLYING PLANS 10c—3 for 25c
Sparrow Hawk, Boeing Trans. 247, Spad Chass., Vought Corsair, Curtiss Swift L. W., Waco Cabin Biplane, Douglas Dolphin, Boeing P12F, Fokker D-VII, S.E.5, Goshawk, Gee Bee, Boeing P26A, Monocoupe, Northrop Gamma, Fairchild 24 Cabin.

SELECT ANY 2 OF THE ABOVE PLANES
In 2-in-one FLYING KIT
with carved prop, complete. Postpaid in U.S.A. (Free offer will not be included with 2-in-1 kits unless order amounts to $1.50 or over.) **75c**

36" KITS
CORBEN SUPER ACE
FOKKER D-VII
Complete. Add 20c postage. **75c**
CURTISS GOSHAWK
Add 25c postage **$1.00**

No free offer with 36" kits
SEND FOR FREE CATALOG
Send For Wholesale Price List
IMPERIAL MODEL AERO SUPPLY
416A McDONALD AVENUE BROOKLYN, N. Y.

3 GOOD CLOCK & COMPASS BUYS

AIRPLANE MOTOR CLOCK
This fine 6-inch model of a 9-cylinder aircraft engine fitted with reliable clock movement made of unbreakable metal with attractive chromium plated exhaust ring. Just the thing for your den, home or office. 30-day wind movement or electric movement. Price **$3.95.**

PROPELLER CLOCK
Electric or wind movement encased in beautifully finished propeller measuring 27 inches. A real ornament for your office or den. Only **$4.50.**

AUTO COMPASS (Airplane Type)
Get this instrument for your car. It's the latest thing. Installed in one minute. Similar to Airplane compass being of the liquid type and having a rotating dial with jeweled pivot. A compensator is also given (not shown) to be placed under this instrument to offset magnetic effect of steel and electrical equipment in your car. Why take the wrong route? Know immediately whether your direction is right or wrong. Priceless on long trips. ORDER ONE TODAY. Price only **$1.98** complete with full instructions.

Send check or money order at once to take advantage of the above prices which are specially priced to reduce stock. If C.O.D. slight additional charge for postage.

AVIATION PRODUCTS CO.
619 S. Federal St., Dept. P. A. 10, CHICAGO, ILL.

COMET LEADS!

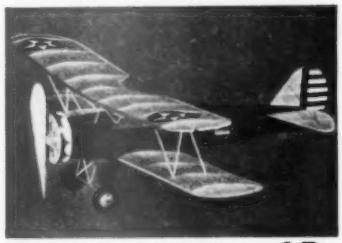
with THESE TWO SENSATIONAL LINES OF COMET KITS

ONCE more—Comet maintains its leadership in the model airplane field, by announcing two complete, different lines of kits—each offering amazing values in every price range! Here are the kits you want to build—perfectly designed, and easiest to build!

The COMET 1-STAR LINE

CURTISS-WRIGHT OSPREY
31" wingspan—Kit No. A-160..... **50c**
Exact Scale—1" equals 1'

STINSON SR-7—Kit No. A-147. 25" Wingspan **25c**



CONSOLIDATED TRAINER BT-7—16" Wingspan. Kit No. A-150..... **10c**

COMET 1-STAR KITS

BIG wingspans and big values are the outstanding features of the COMET 1-STAR LINE! But when Comet gives you big wingspans—it doesn't sacrifice detail and quality—no, sir! COMET 1-STAR kits are amazingly complete—a pleasure to build and a joy to the eye! All the popular models—we show and list only a few here—you'll find the complete line at your Comet dealer's:

NEW 50c 1-STAR KITS
Drawn to Exact Scale of 1 inch equals 1 foot

32" DeLuxe Monocoupe 90A Kit No. A-175	50c
34" Waco S-6 Cabin Plane Kit No. A-177	50c
31½" U. S. Army Consolidated BT-7 Kit No. A-178	50c

COMET 2-STAR KITS

THE supreme thrill of model-building is packed into every COMET 2-STAR kit! These models bring you a wealth of detail which enables you to turn out the snappiest jobs you've ever laid eyes on! Not just quality—but SUPER-quality—not just detail, but SUPER-detail! Only Comet's great resources and huge volume makes it possible to offer these marvelous kits at such low prices! Your dealer will show you many other models in addition to those listed and illustrated here:

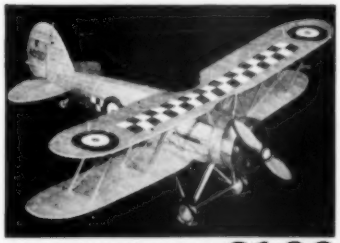
Westland Wallace . . . Kit No. 517 Wingspan 18" **50c**
Martin Torpedo . . . Kit No. 510 Wingspan 18" **50c**
Curtiss Goshawk . . . Kit No. XI Wingspan 19½ **$1.00**
Hawker Fury . . . Kit No. X9 Wingspan 19¼ **$1.00**

Comet Kits Build Themselves by the Exclusive "Auto-Line-Up" Method

The COMET 2-STAR LINE

BRISTOL BULLDOG—18" Wingspan. Kit No. 518..... **50c**

BOEING F4B-4—15" Wingspan. Kit No. 512..... **50c**



GLOSTER GAUNTLET—21" Wingspan. Kit No. X-10..... **$1.00**

COMET MODEL AIRPLANE & SUPPLY CO.
2509 W. CERMAK ROAD CHICAGO, ILL.

DEALERS: There are Comet distributors everywhere

In order to serve you promptly and efficiently, Comet maintains distributors in many cities throughout the United States and other parts of the world. Our Foreign Distributors include: F. P. SWEETEN, Blackpool, England; R. W. HILL, Capetown, South Africa; E. J. HYAMS and Son, Wellington, C.I., New Zealand; V. H. MELKONYAN, Ortakoy, Istanbul, Turkey; SOCIEDAD COMMERCIAL, Salfa, Ltda., Santiago, Chile; L. M. STONE Y CIA, Lima, Peru; SWEDISH-AMERICAN TRADING CO., Stockholm, Sweden; SWIFT MODEL AIRCRAFT CO., Brisbane, Queensland, Australia.

NEW
AMERICAN CIRRUS
and
WRIGHT GIPSY
Engines & Parts
R. J. Wenger
MENASCO MANUFACTURING COMPANY
6714 McKinley Ave., Los Angeles, Calif.

MONEY SAVING **BARGAIN BOOK** of **CAMERAS & SUPPLIES**
FREE Illustrates latest developments in Photography and Home Movie Making, for **fun and profits.** Offers hundreds of amazing, money-saving Bargains in still and movie Cameras, Lenses, Films, etc. We take your old camera or equipment in trade. Write for free bargain book now!
CENTRAL CAMERA CO., Est. 1899
230 S. Wabash, Dept. PA-10, Chicago, U. S. A.

Go Ahead!

At that signal the pilot "gives the gun" to the powerful Pratt & Whitney Wasp engines. The Hamilton Standard Constant Speed Propellers bite into the air at 2250 r. p. m. And you soar away on your three-mile-a-minute trip . . . as gracefully as any bird.

Wasp engines are now powering 50,000 miles of scheduled flight daily for United Airlines.

Airways

(*Continued from page* 38)

ACCORDING to Transcontinental and Western Air, Inc., the passenger load for the entire month of May in its fleet of Douglas "luxury" air liners averaged 74.09 per cent capacity, a record for the New York-Los Angeles run. Performance efficiency for the same period is given as 99.75 completed scheduled flights.

EAL APPOINTMENTS

ROBERT H. EBBITTS, division traffic manager for Eastern Air Lines, states that the Chicago office has increased its personnel with the addition of Miss Dorothy Caraty, Stewart W. Beatty, Clifton H. Power and Charles A. Cooper, Jr.

* * *

DURING 1935, thirty-five of the United Air Lines' stewardesses were married and with leap year the company evidently doesn't intend to take any chances with cupid and now refuses to consider applicants contemplating matrimony. Grace Matson, Patricia McCarthy, Hazel Moulsby, Nancy Wilson, Hazel French, and Frances Gosney have already resolved not to listen to the little fellow with the bow and arrow.

* * *

FOLLOWING three disastrous accidents to Netherlands mail planes, senior pilots for the Royal Dutch Airline asked to be permitted to fly the more dangerous runs as a matter of safety and the company agreed as they did not desire to abandon the dangerous run. . . . After accepting the hazardous assignments the pilots were amazed at the company announcement to the effect that their salaries would be cut 400 guilders for each round trip.

CENTRAL AIRLINES

BECAUSE of increasing demand for air travel over the Central Airlines, D. Walter Swan, vice-president in charge of traffic, has added a fifth round trip schedule on Washington-Detroit airway with stops at Pittsburgh, Akron and Cleveland.

Central Airlines has also arranged a practical two weeks' course for members of the graduating class in the School of Aeronautics at the University of Pittsburgh.

Professor Henry Pavian, Dean of the School of Aeronautics, arranged for the practical course through President J. D. Condon of Central Airlines, and the study will include an inspection of the Detroit shops, a visit to the Army and Navy fields at Washington, D. C., and a trip to the Martin plant at Baltimore.

A meteorology and traffic survey will be made in Cleveland, while airline accounting methods, dispatching and airport management will be studied.

* * *

A MOVE is on foot to establish a beacon at Wilbur Wright's birthplace at Millville, Ind. . . . T.W.A. pilots are now known as captains and first officers. . . . Frank W. Caldwell, engineering manager of the Hamilton standard propeller division of United Aircraft, has received the Sylvanus Albert Reed award for 1935. . . . Charles F. Abel, noted glider of Chicago, has been named honorary aeronautical inspector for the Illinois Aeronautics Commission. . . . The new red and blue air mail special delivery stamp costs 16 cents. . . . Amelia Earhart plans a solo flight around the world to start soon. . . . Pilot Joe Crosson has made another Alaska mercy flight, carrying scarlet fever serum from Juneau to Fairbanks. . . . The giant French seaplane, Lieut. De Vaisseau Paris, completed its sea flight at Pensacola, Fla. . . . Good news was the rescue of Lincoln Ells-Kenyon.

INSTALL NEW EQUIPMENT

PENNSYLVANIA Airlines has placed in operation on its entire Washington-Detroit-Milwaukee route a fleet of modern high speed Boeings, replacing the tri-motored Fords used by the line since last February. In compliance with Air Bureau of Commerce regulations, the planes are equipped with specially designed flotation gear for the flights across Lake Michigan.

This line also reports an all time record for its nine years of operation when 5,807 passengers were carried during the month of July, which represented a 49 per cent increase over the corresponding month of last year.

WOMAN RUNS AIR LINE

PETITE Marguerite Clark, widow of the millionaire aviation enthusiast, Harry P. Williams, and also former great star of the silent movies, now heads the air service founded by her husband and his pal, Jimmy Wedell, who preceded Williams in a fatal plane crash.

The Wedell-Williams Air Service Corp. operates mail and passenger service between Baton Rouge and Houston, Tex.

END.

$1. One Dollar Saves You $50.

When You Learn to Fly

"CLEVENGER'S FLIGHT MANUAL" Will give you an unbelievable insight to the Art of Flying. Tells how and why students make mistakes and the methods of instruction to correct them. Has a world of complete and practical information on each and every page. Contais Pilots Log Book. A complete system of Flight Instruction for the use of Flying Schools. Based on over 1,000,000 miles of flight covering seventeen years as an aviator.

You can't afford to be without the information contained in this book whether you are a student, a sportsman pilot, a professional pilot, the operator of a flying school or just interested in aviation. Prepare yourself by getting a professional knowledge of flying so that you will become a "Master Pilot."

Published by
PRICE **$1.00** ★ **THE PORTERFIELD AIRCRAFT CORPORATION** ★
In advance. Postage paid. 2461 Charlotte St. Kansas City, Mo., U. S. A.

Swanee Taylor

(*Continued from page 22*)

done of a remedial nature until the present corps of executives either go, or else learn to take heed of civilization's progress. Once this is accomplished, internal petty politics will dwindle before the company's march of progress, and your investors will begin to enjoy an unending parade of dividends.

(*Next time, Production*).

Model Contest . . .

It is impossible to wind up this month's stint without a nod to Berry Brothers Paints for the swell model contest they've started on the back cover. Not only do Berry Brothers give our model fans the very latest types (scoops, all of them), but the boys and girls have an opportunity to compete for delightful cash awards.

Recently I helped judge a Junior Birdman model contest, and I don't mind telling you that the winning jobs were marvels to behold. There are a lot of model contests in the offing. You'll do well to get in practice to win a sizeable cash prize or a scholarship. There is one big one that's going to award twenty-five aeronautical engineering scholarships next year. Better start practicing for that one, now.

END.

Stress

(*Continued from page 40*)

stresses are found. For magnitude of stresses measure length of lines on scale No. 12.

To find kind of stresses present in the members we will investigate joint 2 to illustrate the method used. B-C is the load pulling down; then follows C-F which in Fig. 11 points towards the right and in Fig. 10 towards the joint; the member is in compression.

Then follows F-E which in Fig. 11 points upwards and in Fig. 10 away from the joint; the member is in tension. The next is E-B pointing towards the joint; the member is in compression. To be correct the same member investigated at various joints must have the same kind of stresses.

Stress diagrams are not hard to construct if a sharp pencil and straight drawing utensils are used.

END.

Gas Models

(*Continued from page 46*)

On the second flight the ship made a perfect take-off, climbed slowly and steadily until the motor unexpectedly "conked", and then started a long flat glide. Had it not been for the motor trouble, Leo probably would have been near the top of the list of winners.

Hewitt Philipps of Belmont, Massachusetts, created a great deal of interest among spectators and contestants with his low-wing, twin rudder, retractable landing gear job. After the model left the ground on its official flight, the landing gear snapped up into recesses in the wing, and a very realistic take-off was made.

The ship climbed steeply under the surging power of its Hurleman Aristocrat engine and soared away for a thirty minute and twelve seconds flight. On coming down the model picked the only tree in an almost treeless expanse of ground to land in. All efforts to retrieve the model without damaging it were futile. When the ship was gotten down, all that remained of it was a few scattered pieces of wreckage.

Hewitt's experiment certainly was an interesting, even though costly one, If the model had not landed in the tree, its builder would probably have been praying for soft grass, as there was no means of lowering the landing gear when the ground was approached.

Philipps' model probably had slightly more efficiency than other designs because of the retractable landing gear, but it is doubtful whether such a design is practical as damage is almost certain to occur to some part of the model when it lands on its belly. Furthermore, the resistance of a steel wire landing gear is so small that it might be considered as negligible.

(*Concluded on page 70*)

Full size, heavy duty Aladdin Electric ARC WELDER only $39.25 with De Luxe Accessories! Has efficiency of machines costing $145.00 to $800.00. Welds all metals and alloys from heavy motor blocks to fenders and light sheet metal. Also fine for soldering and brazing. Fully guaranteed. Easily portable on casters.

WORKS FROM 110-v. SOCKET. Simply plug into 110 Volt or 220 Volt light socket—costs only few pennies an hour to use. Anyone can use easily. Full instructions included. AMAZING DETAILS FREE! Write today for sensational facts.

Only $39.25 With Deluxe ACCESSORIES

COMMONWEALTH MFG. CORP.
3785 Beechmont Ave., Dept. K-71, Cincinnati, O.

SMASH! BALSA SUPPLIES CUT TO THE BONE

These prices apply only to orders for $2.50 or over.

FREE YOUR CHOICE OF DOZEN BOTTLES CLEAR CEMENT OR CLEAR DOPE (RETAIL VALUE 70c), OR 225 FEET 1/8 FLAT RUBBER. If rubber is desired, add 10c handling charge.

On orders of $10.00 or over, 1/2 gallon cement **FREE**

We do not limit quantities of any item

18" BALSA Per 200		PROP. BLOCKS PER DOZ.		WASHERS, PER 100	
1/32x1/16	9c	1/2x3/4x5	8c	1/8 or 1/4 O.D.	5c
1/16x1/16	9c	1/2x3/4x6	5c	MACHINE CUT PROPS, per doz.	
1/16x3/32	18c	3/4x1x7	14c	5"	20c
1/16x1/8	19c	3/4x1x8	17c	6"	21c
1/16x3/16	24c	3/4x1 1/4x10	29c	7"	30c
1/16x1/4	26c	3/4x1 1/4x12	34c	8"	35c
1/16x1/2	60c	1x1 1/2x12	38c	10"	45c
3/32x3/32	24c	1x1 1/2x15	52c	12"	60c
1/8x1/8	29c	BEST BAMBOO		WHEELS, doz. Birch Bal. Col.	
1/8x3/16	48c	1/2"x1/2"x15 doz.	8c	1/2"	.05 .09
1/8x1/4	52c	1/2"x1/2"x12 gross	15c	3/4"	.06 .11 .24
3/16x3/16	65c	CLEAR DOPE		1"	.08 .14 .25
1/4x1/4	80c	1 oz. doz.	40c	1 1/2"	.10 .19 .35
1/4x1/2	$1.50	2 oz. doz.	60c	1 3/4"	.15 .35 .60
1/2x1/2	2.15	1/2 pt. 25c 1 pt.	35c	2"	.75 1.50
1x1	3 for 6c	1 qt. 65c 1/2 gal.	90c	WIRE, 100 FT.	
1/2x2	2 for 8c	1 gal. each,	$1.50	No. 6	20c
2x2	2 for 23c	COLORED DOPE All colors.		No. 8	23c
1x1 1/2	2 for 11c	1 oz. bot. dz.	50c	No. 10	25c
2x3	2 for 32c	2 oz. bot. dz.	75c	No. 12	30c
1/64x2	20 for 18c	1/2 pt. 27c 1 pt.	45c	No. 14	35c
1/32x2	20 for 14c	1 qt.	70c	PROP. SHAFTS 1 gross	45c
1/16x2	20 for 17c	1/2 gal.	$1.25	NOSE BLOCKS, PER DOZ.	
3/32x2	20 for 20c	BUSHINGS		1x2x1	6c
1/8x2	20 for 22c	1/16 I. D. 100	15c	2x2x1	12c
3/16x2	20 for 31c	CLEAR CEMENT		3x3x1	20c
1/4x2	20 for 40c	1 oz. bot. dz.	45c	3x3x2	39c
3" sheets or 36" lengths, double above prices and add 10c packing charge for 36" lengths.		2 oz. bot. dz.	65c	RUBBER BEST QUALITY .225 ft. skeins.	
		1/2 pt. 25c Pt.	40c	.045 sq.	25c
		1 qt.	60c	1/16 sq.	27c
		1/2 gal.	$1.00	1/8 flat	35c
		1 gal.	1.75	1/2" NOSE PLUGS	
		5 gal.	6.50	1 doz. 5c 100.	35c

Remit with order. Because of these low prices, we do not pay shipping charges. No C.O.D.'s. No stamps. Send for complete price list.

RELIABLE DEALERS SUPPLY
416 Gravesend Ave., - BROOKLYN, N. Y.

FUN *to make*

Wiley Post's Winnie Mae is fun to make with strong, quick-drying, easy-to-use Du Pont Duco Cement. Light in weight. Used by model builders everywhere.

FOR FREE BLUEPRINTS of this flying model of the Winnie Mae, send red disc from 25c tube of Duco Cement. DU PONT, Dept. H-5, Wilmington, Delaware. *Also choice of plans for Navy Hell Diver, Akron Fighter, Laird 400.*

TRANSPARENT • WATERPROOF

DU PONT **DUCO** *Household* **CEMENT**

Cooper-Built Hangars

FOR PRIVATE OWNERS

Year-round protection for your ship—it deserves it.

Cooper-built is a sectional, metal hangar, sturdy and equipped with foolproof doors that really work. It can be erected in less than a day.

Your engineering and construction already done—all you do is bolt it together. Shipped anywhere.

PRICE, COMPLETE, $298

Write for Booklet H36

BENNETT AIR SERVICE (National Distributors) Central Jersey Airport Hightstown, N. J.

YOU NEED THIS BIG CATALOG

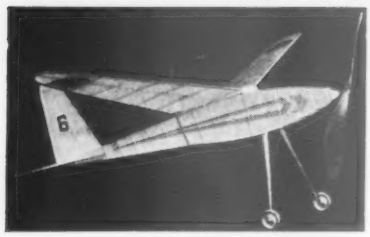
Chock-full of Values in Helmets, Goggles, Instruments, etc.

Send 10c for Copy which will be refunded on First Order.

Send for it TODAY

AVIATION PRODUCTS CO.
619 S. Federal St., CHICAGO

CHAMPIONS



FOR REAL FLIGHTS

CADET MAJOR–CADET Jr.,

Span 30" Area 102 Sq. In. — Span 20" Area 45 Sq. In.

Here are the two greatest performers ever designed for Model Builders. Thousands have been sold and from everywhere come enthusiastic reports on their Prize Winning flights.

Why experiment with unproven models when the Cadet Major and Junior guarantee you Championship performance.

Why jeopardize your chances of winning . . . . when these famous models have so many wins to their credit? Line up with a champion! Fly a Champion Win with a Champion! Order your Cadet Major or Junior today.

CADET MAJOR Kit	Postpaid $1.50
CADET Jr. Kit	50c Plus 10c Postage
Both Kits, Postpaid	$2.00

Send 3c Stamp for Catalogue

BUNCH MODEL AIRPLANE CO.

2303 S. Hoover St. Los Angeles, Calif.

BUILD SELLEY-TEX PATENTED New Sensational Moulded Models

Easy to build, durable, and regardless of your choice each Selley-Tex Kit is a masterpiece of authentic reproduction endorsed by experts and Model Builders everywhere as the finest and the most practical kit you can purchase. 12 Beautiful Flying Scale Models to select from.

LOCKHEED ORIONS 1.25 Plus Postage

12 models to choose from

Wing Span, 20" Length . . . 12¾"

Rearwin	.75			*Boeing	
Bellanca	1.00	Lockheed	1.25	F4B4	3.50
Monocoupe	1.25	*Ryan Sport	3.00	*Geshawk	4.00
Osprey	1.25	*Fairchild 22	3.00	*Waco D	
Corsair Jr.	1.25	*Waco Cabin	3.50	Military	4.00

Add 15c Packing and Postage *25c

Each kit is fully complete with indestructible moulded fuselage, cowl, motor, etc. Best grade of selected Balsa, colored Jap tissue, colored authentic insignias, colored dope and cement, two propellers, formed wire parts, special turned wood parts and best grade of para rubber.

SELLEY-TEX PARTS

Each of the SELLEY-TEX Construction Sets contains the necessary individually designed moulded scale parts similar to those shown above.

YOUR PROTECTION

All Selley-Tex kits are sold with our unconditional guarantee that kit may be returned if unsatisfactory and money refunded.

Manufacturers of the largest and most complete line of Model Boat, Airplane Fittings, Supplies and Accessories in the world. Send 5c for Airplane Catalog, 5c for Boat Catalog.

Try your leading Dept. store or local dealer first. If you can't get SELLEY-TEX please mention your dealer's name and address.

DEALERS—JOBBERS, write for new confidential list.

SELLEY MFG. CO. INC., Dept. 410 1373 GATES AVE. BROOKLYN, N.Y.

Gas Models

(*Continued from page 69*)

Mike Kostich of Akron, Ohio, triumphed in the open class when his model set a new world's record of thirty-six minutes and fifty-two seconds. Unfortunately no data concerning Kostich's model were available to the writer at the time this was written.

Bill Atwood, the designer of the Baby Cyclone engine and a veteran model builder traveled from California to enter the meet. He flew a number of creations of his own design, each of which performed beautifully.

A five foot Stinson gas model powered with a Baby Cyclone spiralled up into the sky, and, after the engine cut, descended in a fast flat glide to a perfect landing on the runway.

Bill did not use this model as his contest ship but merely to "play around with." Bill's contest model looked like a stick model but had its required amount of cross-sectional area built into its streamlined nose. The nose housed the single wheel landing gear.

With Atwood from California were Roderick Doyle and Ira Hassad. Both boys had excellent flying ships and placed high in the list of winners. Hassad's ship, a small job having a wingspread of about four feet, was powered with a tiny engine having a bore and stroke of half an inch. The motor was constructed by Mel Anderson of California. This engine and others of the same size owned by other contestants attracted quite a bit of attention.

Statements from contestants to the effect that if small, reliable power plants of the size specified were manufactured to sell for no more than fiteen dollars, there would be a great market for them, were heard.

Manufacturers of model plane engines seem to be favoring those sizes of motors which require installations in eight to ten foot jobs. It might be wise for these people to consider the matter of producing smaller engines in a more serious light.

While there would probably not be very much difference in the prices of a large and small engine, or at least not as much difference as the average builder would expect, yet the use of a small power plant in connection with a correspondingly smaller model would reduce the total or overall cost and lead to the production of a more manageable job.

The great trouble with engine construction is the fact that labor and merchandising cost are by far the greater items in the cost of manufacture and not simply material, hence cutting the dimensions by half would not, by any means, cut the cost in half. The amount of material used in either case is not of very great importance.

There have been several models built on the West Coast with the small engine mentioned above which have been quite popular with the gas-model fans. There is no doubt but what small models with small engines will prove exceedingly popular in the future and will lead to many interesting developments.

Four-cycle engines have not yet put in an appearance on the open market but they, when properly designed, will probably make it possible to construct smaller models. While the cylinders of four-cycle engines are somewhat larger than those of the two-stroke variety, yet the weight is less because of the greater efficiency of these engines. It will be interesting to see what develops along this line. Easier starting, more uniform firing with less tendency toward cutting out will almost be certain features.

Vernon Boehle, former outdoor model airplane champion, showed his prowess in the gas event by obtaining a flight of over twenty-four minutes with his giant size "model" of fifteen foot wingspread. The amazing feat of the model was its beautiful flight on the power of a Baby Cyclone engine.

Usually a ship of this size requires a half horsepower engine, but Boehle proved that by using a high strength-weight ratio, a large ship could be built light enough to fly on the amount of power available in engines of the Baby Cyclone's size.

There were a number of ships on the field which resembled none of the others entered in the gas event. Ben Shereshaw who led the Kresge Aviation Club delegation from Newark, N. J., entered a large twin boom pusher model.

The motor was faired into the rear of the fuselage nicely, and damage to the motor and propeller was thus prevented. On its first flight the ship hit a fence during the take-off and was damaged. On a subsequent flight the model flew nicely and secured a duration of almost four minutes. Motor trouble prevented longer flight.

Emanuel Radoff, of Newark, N. J., flew a ten foot job which resembled the K-G models in general appearance but which differed in two respects. The airfoil, a Radoff "snakehips" design, had a deep indentation in the upper camber for the purpose of increasing the amount of vacuum and consequently the lift of the wing. The model rose like an elevator but had very little forward motion in climbing as compared to that of conventional designs.

This performance was probably due to the fact that the type of airfoil used possesses a low L/D ratio. The other distinguishing feature about Radoff's job was his excessively high wing mounting.

The model naturally was stable, but its glide was mushy because of the greater resistance imparted by the "snakehips" airfoil and the high wing mounting. Radoff's ship placed in the open event with a duration of over seven minutes.

The model entered by the writer was of conventional design except for the wing which used a flat center section and dihedralled tips. The features of the design are its long tail moment arm, large elevator area, and the nose construction.

This last feature attracted attention because of its dissimilarity with the

conventional types of noses. The motor mounts of bass are embedded in slots cut in 1/8" bass plywood bulkheads, and the entire top covering of the nose is three ply birch veneer of 1/32" thickness.

Such construction proved its worth when the model came down in a steep dive with the power on. Not a member in the nose was loosened or broken. Another advantage of this construction is that most of the engine vibration is absorbed by the wood in the nose.

The model made a beautiful official flight, which incidentally was its first after the completion of the ship, of 11 minutes and 13 seconds. The Hurleman Aristocrat engine proved to be too powerful for the three pound job, for on the second official try, with the engine running wide open, the model climbed steeply and then started a spiral.

The resultant crash caused a wing tip to break and prevented further flying for the day. This particular ship is the outgrowth of a number of ideas which were tried and proved in previous designs. The light wing loading and high power loading gave the model a fast climb and a slow, flat glide. The engine ran for about two minutes during the model's official flight, and the ship soared for the rest of the time.

The results of this Texaco gas event have proved a number of things concerning gas model design. The tendency of builders, it appears, is to build strong, light models, and allow them a reserve of flying power. Long tail moment arms and large elevator areas are popular. The steel wire landing gear with air wheels was used almost entirely. The advantages of such a landing gear are that it will absorb the greater portion of shock due to crashing or landing, and it is lighter in weight than other types of gear.

Polyhedraled wings, that is, wings with flat center sections and dihedraled tips, have become increasingly popular. The advantages derived through using this type of wing construction are its greater strength/weight ratio and also its excellent gliding and flying characteristics. Very little dihedral in the tips is required. In fact, excessive dihedral at the tips will cause the model to bank excessively if the amount of fin area is not wisely chosen.

The placing of the line of thrust of the engine at or slightly above the center of gravity of the model has proved to be good practice. A line of thrust below the C.G. will produce a stalling moment when the motor is running. The absence of this nosing up effect after the motor has cut might cause the model to dive. A model may be adjusted to fly well with this arrangement, but the adjustment will be very sensitive. This is not to be desired. By placing the line of thrust at the C.G. or slightly above it, one may be assured of a smooth, steady performance from the model during its flight.

Multi-spar wing construction is not as popular as it used to be. The single spar of narrow but deep cross-section has as much strength and greater flexibility than does a set of wing spars.

Balsa sheet at the leading edge strengthens the wing and also serves as a shock absorber for the wing when the latter meets with an obstruction.

From the writer's viewpoint, the most prominent changes during the year have been in construction rather than in design. As has already been stated, model builders have found types of construction that have high strength/weight ratios. This is as much of an achievement as to come forth with a radical design of merit.

Next year's Texaco event is bound to be interesting together with the radio-controlled gas event for which a first prize of two hundred dollars has been offered by the A.C. Spark Plug Co. Without question, the competition will be exceedingly keen.

For those fellows who can afford the time, the example of Maxwell Bassett, who has produced more winning gas jobs and more successful fliers than any other living builder, may well be followed. Bassett attributes his success to practice in flying his models, and nobody can doubt that practice makes perfect.

END.

Analysis

(*Continued from page* 40)

chrome-molybdenum alloy steel and those the composition of which is medium carbon steel (S.A.E. 1025), normalized specimens of both materials are subjected to the Rockwell hardness test.

The results will indicate a Rockwell hardness number in excess of 90-B for the chrome-molybdenum alloy steel, while the medium carbon steel will exhibit a value of Rockwell hardness below 80-B.

Aero Books For Sale

We have books on every branch of aviation, historical, technical, adventure, etc., that are both informative and interesting.

POPULAR AVIATION
608 S. Dearborn St. Chicago, Ill.

2 BIG VALUE C-D 20" REP FLYERS

Be sure to build 'em. C-D's lead the world in quality, value and performance.

Send 3c stamp for catalog. DEALERS WRITE!

HAWKER FIGHTER

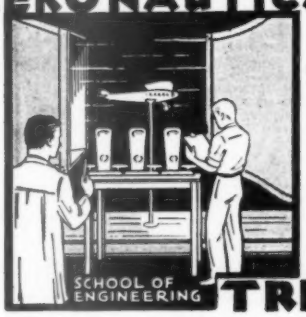
GRUMMAN F2F-1 FIGHTER

★ Landing gear fully retracted as on the prototype, coloring suggested all silver; insignia supplied. Kit R-57 complete (except liquids) postfree only..... 50c

★ Latest Navy fighting ship, still on secret list. Big wing area makes model splendid flyer. Drawings cover both retracted or extended landing gear. Kit R-53, complete (except liquids), postfree, only..... 50c

CLEVELAND MODEL & SUPPLY CO., INC., 1866PA West 57th St., Cleveland, Ohio, U. S. A.

AERONAUTICAL ENGINEERING
DEGREE IN 2 YEARS



Become an Aeronautical Engineer. Tri-State College course given in 108 Weeks. Bachelor of Science degree. Graduates in Mechanical Engineering can complete aeronautical course in 2 terms (24 weeks). Thorough training in all fundamental engineering subjects. Equipped with wind-tunnel (see illustration). Non-essentials eliminated. Courses designed to save student time and money. Flying school facilities available at nearby airports. Properly trained engineers in design, research, manufacture and sales work are in demnd. Enter September, January, March, June. Courses are offered also in Civil, Electrical, Mechanical, Chemical, Radio Engineering; Business Administration and Accounting. Living costs and tuition low. Those who lack high school may make up work. World famous for technical 2-year courses. Graduates successful. Write for catalog.

7106 COLLEGE AVE., ANGOLA, IND.

TRI-STATE COLLEGE

Use **"IMP"** Reg. U. S. Pat. Off.
PAULOWNIA WOOD
PROPELLERS on all your jobs!
"Are as Light as Balsa with Twice the Strength"

Accurately Carved and Carefully finished by hand; true balance; hole drilled for shaft; high lustre varnished. The preferred propellers with thousands of flyers; lighter, stronger, more efficient. Use them on your models and see the difference.

None Genuine Without this Trade Mark.

Your regular dealer will supply genuine "IMP" Propellers at these money saving prices; if unobtainable, send your order direct:—

Size		Standard Type	Helical Navy Type	Steel Type
5 in.	each	10c	5c	12c
6 "	"	12c	7c	18c
7 "	"	15c	10c	20c
8 "	"	18c	12c	25c
9 "	"	20c	15c	30c
10 "	"	22c	20c	35c
11 "	"	30c	25c	40c
12 "	"	35c	30c	50c
13 "	"	45c	35c	55c
14 "	"	55c	40c	65c
15 "	"	65c	50c	75c
16 "	"	80c		90c
18 "	"	1.00		1.00
20 "	"	1.25		1.25

Standard Type—Left or Right hand pitch; 5 to 15 in. Steel Type—Varnished, Plain or Silvered.

Orders less than 50c, add 5c postage. With all orders 50c and over we will include FREE one of our IMP Free Wheeling Combinations.

Send 3 cents for Latest Propeller Guide and Catalog of "IMP" Specialties

INTERNATIONAL MODELS CO.
1785 Broadway—General Motors Bldg., New York.
British Agents for all IMP Products
MODEL AIRPLANE STORES
42 Derby Road, Prestwich, Lancs.